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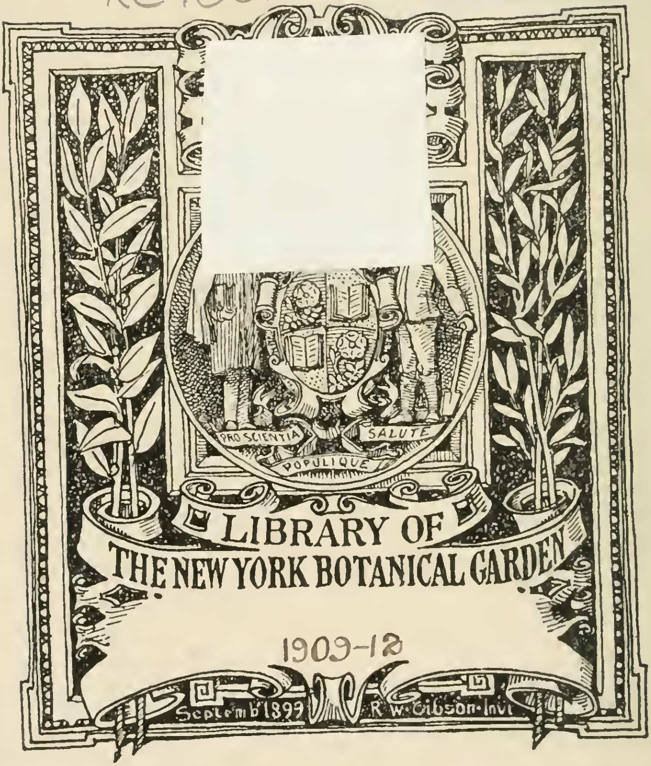
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VOLUME VI

1909–1912

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CONTRIBUTIONS

FROM

The New York Botanical Garden

VOLUME VI

(Nos. 126–150)

WITH 60 PLATES AND 5 FIGURES

1909-1912

PUBLISHED FOR THE GARDEN
AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY.

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vol. 6
1909/12

TABLE OF CONTENTS

No. 126. The Genus Ceratopteris: A Preliminary Revision, by Ralph Curtiss Benedict.

No. 127. The Crataegi of Mexico and Central America, by W. W. Eggleston.

No. 128. Studies on the Rocky Mountain Flora—XIX, by Per Axel Rydberg.

No. 129. Studies on the Rocky Mountain Flora—XX, by Per Axel Rydberg.

No. 130. Monographia Generis Arthroclianthi Baill., by B. P. G. Hochreutiner.

No. 131. Studies on the Rocky Mountain Flora—XXI, by Per Axel Rydberg.

No. 132. Sphaerocarpos hians sp. nov., with a Revision of the Genus and Illustrations of the Species, by Caroline Coventry Haynes.

No. 133. Iowa Discomycetes, by Fred Jay Seaver.

No. 134. Studies on the Rocky Mountain Flora—XXII, by Per Axel Rydberg.

No. 135. Studies of West Indian Plants—III, by Nathaniel Lord Britton.

No. 136. Notes on Rosaceae—III, by Per Axel Rydberg.

No. 137. Studies on the Rocky Mountain Flora—XXIII, by Per Axel Rydberg.

No. 138. Notes on Rosaceae—IV, by Per Axel Rydberg.

No. 139. Additions to the Flora of Peninsular Florida, by John K. Small.

No. 140. Studies on the Rocky Mountain Flora—XXIV, by Per Axel Rydberg.

No. 141. Studies on the Rocky Mountain Flora—XXV, by Per Axel Rydberg.

No. 142. Notes on Rosaceae—V, by Per Axel Rydberg.

No. 143. Results of a Preliminary Study of the so-called Kenai Flora of Alaska, by Arthur Hollick.

No. 144. The Paleobotanical Collections of the New York Botanical Garden, by Arthur Hollick.

No. 145. Notes on Rosaceae—VI, by Per Axel Rydberg.

No. 146. Phycological Studies—V. Some Marine Algae of Lower California, Mexico, by Marshall Avery Howe.

No. 147. Studies of West Indian Plants—IV, by Nathaniel Lord Britton.

No. 148. List of Plants Collected on the Peary Arctic Expedition of 1905–06 by Dr. L. J. Wolf, and of 1908–09 by Dr. J. W. Goodsell, by P. A. Rydberg.

No. 149. Studies in Pyrophilous Fungi—III. The Viability of the Spores of Pyronema, by Fred J. Seaver.

No. 150. The Individuality of the Chromosomes and their Serial Arrangement in Carex aquatilis, by Arlow Burdette Stout.

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CONTRIBUTIONS FROM THE NEW YORK BOTANICAL
GARDEN—No. 126

THE GENUS CERATOPTERIS: A PRELIMINARY REVISION

By RALPH CURTISS BENEDICT

NEW YORK
1909

Reprinted, without change of paging, from BULLETIN OF THE TORREY BOTANICAL CLUB **36**:
463-476. 3 S 1909.

From the Bulletin of the Torrey Botanical Club, 36: 463-476. 1909.

The genus Ceratopteris: a preliminary revision

Ralph Curtiss Benedict

The genus *Ceratopteris* comprises a complicated group of hydrophytic leptosporangiate ferns which vary considerably not only in leaf-form, habit, etc., but also in the more fundamental characters of the sporangium, but which for nearly a century have commonly been regarded as constituting but a single species. Recently, however, Hieronymus,* and Underwood† have dissented from this view and have recognized a second species, but without attempting any revision of the genus as a whole. The present paper has as an object the presentation of such a revision. Owing to insufficient material the revision is necessarily incomplete, but it is believed that it represents a step in advance, and will aid in the further study of these plants.

In reaching conclusions as to the taxonomic status of the various forms, it has been necessary to examine microscopically the sporangia of a large amount of material from many localities. This has resulted in the discovery, of some general morphological interest, that the number of spores per sporangium varies with the different species. Also of interest is the establishment of the fact that this variation, and the variation in the development of the annulus, can be correlated with the variation in leaf-form and that the genus consists not of a single species, anomalous both in variation and distribution, but of several species whose variations do not exceed reasonable limits, and whose distribution, although possibly anomalous in one case, is for the most part comparable with that of the great majority of species. This correlation is furthermore of interest as additional evidence, if additional evidence is needed, as to the value of the study of minute characters in connection with taxonomic work with the ferns. The synopsis finally obtained seems clear enough now, even with respect to the grosser differences in leaf-form, but these differences became clear only after tentative groupings on the basis of the sporangial characters.

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* Bot. Jahrb. 34: 561. 1905.

† Torreya 7: 195. 1907.

In the Engler & Prantl, Die Natürlichen Pflanzenfamilien, the number of spores in each capsule is given as sixteen, and Miss Ford also records this number for the material she examined, but in most of the numerous specimens I have seen, the number was certainly more than sixteen, and for many plants was definitely determined as thirty-two. Only in *C. deltoidea* was sixteen found to be the maximum number. Indeed in some of the material provisionally identified as this species (Porto Rico, *Sintenis*), sporangia with fewer than sixteen spores were apparently present, although this count was not verified. The accurate counting of the spores was rendered difficult by the fragile texture of the sporangium walls. In many well-fruited leaves the capsules seemed to be all ruptured, or would become so in transferring to a slide, and in such cases the full number accredited to the species was often not certainly determined, but an intermediate number, *i. e.*, more than sixteen, was assumed to indicate the larger number.

The genus is peculiar in that it varies as previously noted in characters usually very constant in fern groups of higher rank than genera, *viz.*, the number of spores per sporangium, and the development of the annulus. The discovery of the form with the vestigial annulus so impressed Hooker that he made it the basis of a new genus and two new species, but he later withdrew both genus and species. Now, although there is no question as to the generic identity of all the plants, the specific identity of all seems hardly probable, and one of Hooker's species, *pteridoides*, has again been accepted by Hieronymus and by Underwood for the American plants, which with few exceptions differ markedly from the Old World plants in leaf-form, habit, and habitat.

But the difficulty does not end here. *C. pteridoides* as thus recognized itself includes a complex of forms which differ in form and cutting and in sporangial characters, and probably also in habit and habitat as well, and it was with a view of finding out whether there exists any correlation of these differences among the various forms that the present study was undertaken. The results obtained are so simple that it seems strange that they have not been obtained before. However, as stated in the title, the present revision is merely preliminary, and the indications are that the genus contains not only the several species included here, but probably several more, which further collections and field work will bring more clearly to light.

The principal difficulty that arose was due to the lack of complete series of the different forms through which the leaves pass in their seasonal development. The conditions seem somewhat analogous to those which exist in such plants as *Campanula rotundifolia*, etc., in which the juvenile leaves are often more distinctive than the later growth but may have disappeared before these develop. Thus a large proportion of the material studied represents only the mature sporophyls which, although necessary in determining the sporangial characters, may yet leave the exact identity of the specimen very much in doubt.

A knowledge of the ecology of the various forms would also assist greatly in their classification. The evidence of this sort at hand indicates that some of the plants occupy very different habitats. They have been found growing in merely damp soil, floating or submerged in water which may be running or stagnant, fresh or brackish, at sea-level and up to two thousand feet altitude. All seem to require at least wet soil, and it is not unlikely that all are accustomed to temporary if not continuous submergence, during which the young vegetatively formed plants are borne floating until stranded in some situation favorable to further growth.

The genus (and the monotypic family Ceratopteridaceae *) may be described as follows:

Aquatic or semi-aquatic plants of tropical or subtropical regions. Stem creeping or ascending, reduced, sparsely scaly. Roots borne on the stipes. Leaves alternate, successive, viviparous, soft-herbaceous, dimorphic, the venation reticulate, without included veinlets, the stipes in some species horizontal at first, then bent abruptly upwards, bearing the roots on the horizontal parts. Sterile leaves erect or spreading, floating in some cases, 2–4 times pinnately or subternately divided. Sporophyls taller, erect, 2–5 times divided, the ultimate segments linear, with the margins narrowly and evenly revolute, often meeting along the midvein, covering two or three rows of areolae. Sporangia abaxial, scattered in one or two lines along the longitudinal veinlets, and protected at first by the reflexed margins, thin-walled, sessile, globose, the wall-cells sinuate, containing chlorophyl, the annulus longitudinal, few-celled (4–10), and causing irregular dehiscence, or many-celled (20–70), and with 8–10 lip-cells and consequent regular dehiscence. Spores 16 or 32 per sporangium, ephemeral, triplanate, the inner faces smooth, the dorsal (outer) face rounded and regularly marked with three series of anastomosing ridges.

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* Underwood, Our Native Ferns 78. 1900. [Ed. 6.]

Some of the characters noted are decidedly unusual. The bracing of the plant by means of the elbowed stipes is peculiar, and the place of origin of the roots is even more anomalous. Attention has already been called to these facts by Miss Sibille Ford in connection with a study of the vascular anatomy of *Ceratopteris* "*thalictroides.*"* The bent stipe seems to be a feature present only in the plants which grow rooted in the soil. In the floating plants the stipes are swollen and bulbous, but not bent. Goebel † has noted in the field that one species, probably *C. pteridoides*, may assume either the floating or the anchored habit, and this statement is borne out by the herbarium material of this species examined, but is true for this species only, as all the other forms seem to be adapted at maturity to a fixed habit only.

The genus was described in 1821 by Brongniart, based on the Linnaean species *Acrostichum siliquosum* and *A. thalictroides.* Within seven years six other names had been proposed for the same genus, two of which, however, were not properly published but were merely cited as synonyms. In addition to these, the synonymy contains, besides the already mentioned *Acrostichum*, *Pteris* Swartz and others, *Belvisia* Mirbel, *Onychium* Hasskarl, and *Naias* Blanco.‡

As may be seen, many different views have been held as to the natural position of this genus. Brongniart, who distinguished five families of ferns, *viz.*, Ophioglossaceae, Osmundaceae, Marattiaceae, Polypodiaceae, and Gleicheniaceae, placed *Ceratopteris* with the last because he considered its annulus to be transverse. But he clearly misinterpreted the facts, since the annulus, although sometimes rather crooked, is undoubtedly longitudinal, and its structure resembles that of the Polypodiaceae, from which it differs principally in the size, shape, and number of the component cells. Diels has recognized this relationship in Engler & Prantl's Pflanzenfamilien, where *Ceratopteris* is ranked as a family (Parkeriaceae) coördinate with the Polypodiaceae, Gleicheniaceae, and others in the group Eufilicinae. This seems to be a logical grouping but the indeterminate fructification is perhaps evidence of a less highly organized development and, as has been suggested by Dr. Underwood,* may be taken to indicate for this family a low position in the order to which it belongs.

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* Ann. Bot. **16**: 95–121. *pl. 1.* 1902.

† Pflanzenbiol. Schild. **2**: 281. 1893.

‡ Citations are given under the head of Synonymy.

The conclusions reached as to the classification of these plants are based on an examination of the material in the Underwood Fern Herbarium in the New York Botanical Garden, the Eaton Herbarium at Yale University, and the National Herbarium, and in the citation of specimens, these herbaria are indicated by the letters U, E, and N. I wish to take this opportunity to thank Professor Alexander W. Evans of Yale, and Mr. W. R. Maxon of the National Museum, for the privilege of examining the material in their care.

The following forms seem to deserve recognition as species:

Lamina of the mature sterile leaf usually oblong or narrowly deltoid, pinnately divided; spores 32.
    Annulus well developed, 20–70-celled, lip-cells present; segments of the sporophyl mostly more than 2 cm. long............1. *C. thalictroides.*
    Annulus few-celled, 4–10, lip-cells wanting; segments of the sporophyl mostly less than 1.5 cm. long..........................2. *C. Lockharti.*
Lamina of the sterile leaves broadly deltoid or pentagonal.
    Spores 32; the annulus few-celled, lip-cells wanting; mature sterile leaves floating, the lamina pentagonal, not more than 20 cm. long, 2–4-pinnatifid..3. *C. pteridoides.*
    Spores 16; the annulus well developed, lip-cells present; mature sterile leaves emergent, the lamina deltoid, 25–40 cm. long, 2-pinnate..4. *C. deltoidea.*

1. CERATOPTERIS THALICTROIDES (L.) Brongn. Bull. Sci. Soc. Philom. **1821**: 186. *f. 3, 4.* 1821

Acrostichum thalictroides L. Sp. Pl. 1070. 1753.
Acrostichum siliquosum L. Sp. Pl. 1070. 1753.

Leaves erect, 6–75 cm. long, the stipes 4–27 cm. long; lamina of the sterile leaf narrowly deltoid or oblong, 3.5–28 cm. long, 2–13 cm. broad, 1–2-pinnate-pinnatifid, the pinnae ovate-lanceolate or oblong, the segments linear-lanceolate to oblong or

---

* Fernwort Papers, Linn. Fern Chapt. 17. 1900.

ovate-lanceolate, blunt or acute, 1–2.5 cm. long, 2–5 mm. broad: fertile leaves taller than the sterile, the lamina oblong, 20–55 cm. long, 10–30 cm. broad, 2–5 times pinnately divided, the pinnae and smaller divisions often distant, the ultimate segments flagelliform, 1–6 cm. long, the margins revolute, covering 2 or 3 rows of areolae, and 1 or 2 rows of sporangia with well-developed annulus and lip-cells: spores 32. [FIGURE 1.]

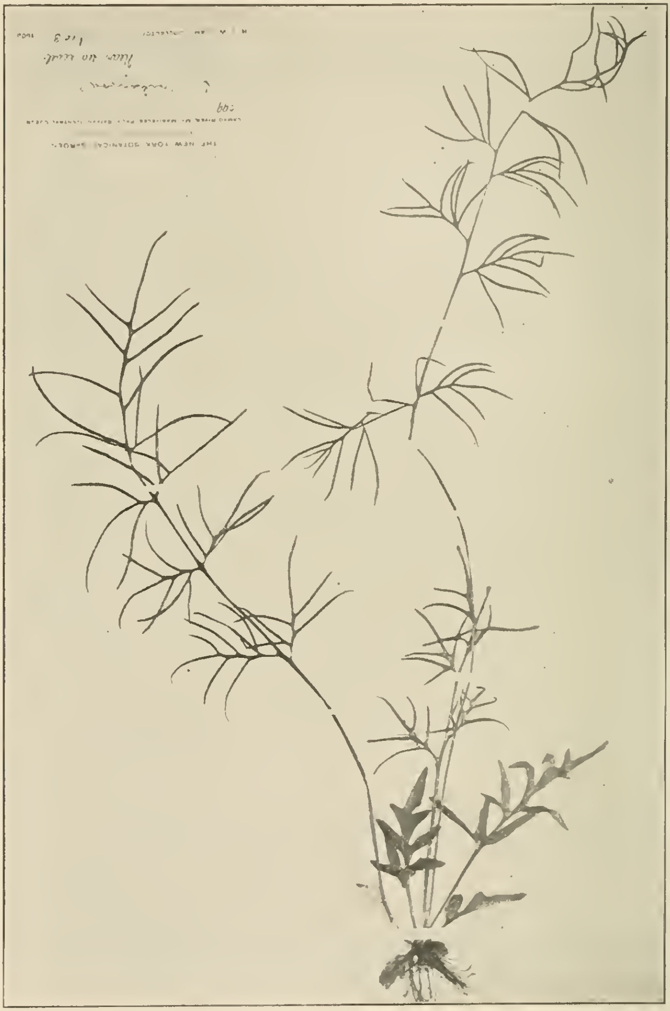

FIGURE 1. *Ceratopteris thalictroides* (L.) Brongn., Lamao River, Mt. Mariveles, Prov. Bataan, Central Luzon, Philippine Islands, *R. S. Williams 299.* About one third the natural size.

Type from Ceylon.

The Old World material appears to be all alike in sporangial characters. In leaf-form there is considerable variation, and probably also in habit and habitat, but the information at hand does not furnish any clue for the separation of the various forms as species. Linnaeus recognized two species, *Acrostichum siliquosum* and *A. thalictroides*, both based on Ceylon material and both forms which can be identified with material of recent collections, but it is not clear that they are more than seasonal variations of the same plant, or perhaps modifications induced by adaptations to different habitats. Mr. R. S. Williams, who has collected the *siliquosa* form in the Philippines, tells me that he found it in grassy hollows, forming small clumps not very dissimilar in appearance to the grass itself, and in situations in which it may not have been submerged at any time. Such a plant would perhaps lend itself more readily to variation in the moisture available than the strictly aquatic American plants, so that its wider distribution and variation are not so anomalous as might first appear.

It appears to be generally distributed in the Old World tropics. From the material seen the following distribution may be recorded: Japan, Formosa, the Philippines, Himalayan region to Ceylon, Malay Peninsula, Java, Andaman Islands, Queensland (Moreton Bay), Madagascar, and Jamaica (?). As already noted some striking forms are included which probably deserve separation. I have not seen any West African material (*C. cornuta*) so do not know whether this should also be included in the *thalictroides* complex or not. The reference to Jamaica is based on a specimen in the National Herbarium * which agrees almost exactly with some of Mr. Williams' Philippine material. It is, however, without data other than that of a stock printed label, no time or place of collection being given, so that it is possible that the plant is not really Jamaican.

2. CERATOPTERIS LOCKHARTI (Hook. & Grev.) Kunze, Linnaea 23: 241. 1850

Parkeria Lockharti Hook. & Grev. Icon. Fil. *pl. 97*. 1828. (In footnote.)

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* The label heading reads as follows: Flora Jamaicensis | No. 124. Coll. John Hart, Supt. Govt. Cinchona Plantation, | Gordon Town, Jamaica, W. I. | *Ceratopteris thalictroides* Brong.

? *Ceratopteris Richardii* Brongn. Dict. Class. Hist. Nat. **3**: 351. 1823.

Slender plants, growing partly submerged: leaves slender, up to 35 cm. long, the stipes slender, terete or flattened, 5–24 cm. long: sterile leaves erect and emergent when mature, 8–18 cm. or more long, the lamina oblong or deltoid, 4.5–9 cm. long, 4–5 cm. broad, 1–2-pinnate-pinnatifid, the pinnae varying from deltoid below to lanceolate above, acute, the ultimate segments lanceolate to deltoid: sporophyls somewhat taller, 10–35 cm. long, the lamina 4 times divided, the ultimate segments linear, 0.5–2 cm. long: sporangia in one row along each margin, the annulus few-celled; spores 32. [FIGURE 2.]

Type from Trinidad, *Lockhart.*

Specimens seen: Trinidad, *no. 1260* Botanical Garden Herbarium, N; Guiana: *Leprieur*, Cayenne, U, N; *Jenman*, Demerara, Glen Island, Essequibo River, "growing in the lake with *Victoria*," U.

Aside from the sporangial differences, this plant resembles *C. siliquosa* considerably, but differs somewhat in general habit, frequents apparently a different habitat, and is particularly unlike the Old World species in the length of its stipes and in the shortness of its fertile segments. A figure of the Jenman sheet is shown in FIGURE 2. The sterile leaves are from a different plant from the sporophyls and probably represent the floating stage. The Cayenne sheet in the National Herbarium had been identified by Leprieur as *C. Richardii* Brongn., but I have been unable to verify this identification, so cannot vouch for its correctness. If it proves to be authentic, Hooker & Greville's name will become a synonym.

3. CERATOPTERIS PTERIDOIDES (Hook.) Hieronymus, Bot. Jahrb. **34**: 561. 1905

Parkeria pteridoides Hook. Exot. Fl. **2**: 147. 1825.

Ceratopteris Parkeria J. Smith, Jour. Bot. Hook. **4**: 70. 1841.

Plants growing floating or near shore and rooted in soil: leaves of the floating plants up to 25 cm. long, the stipes expanded midway, bulbous: lamina in earliest sterile leaves simple, ovate or deltoid, in following leaves broadly 3-lobed, deltoid or rhombic, in still later leaves pentagonal, 6–20 cm. long, 6–20 cm. broad, 1–3 times pinnatifid, with 2–4 pairs of primary divisions, the ultimate segments broadly ovate or deltoid, usually blunt or rounded: lamina in succeeding leaves 2–4 times divided with narrowly oblong, rounded segments, grading into the slightly taller sporophyls with linear segments: leaves in the anchored plants as above but with the stipes not bulbous, with the sporophyls about twice as tall as the sterile leaves and without intermediate forms: sporangia in one row along each margin, without lip-cells, the annulus 4–10-celled, rarely more; spores 32.

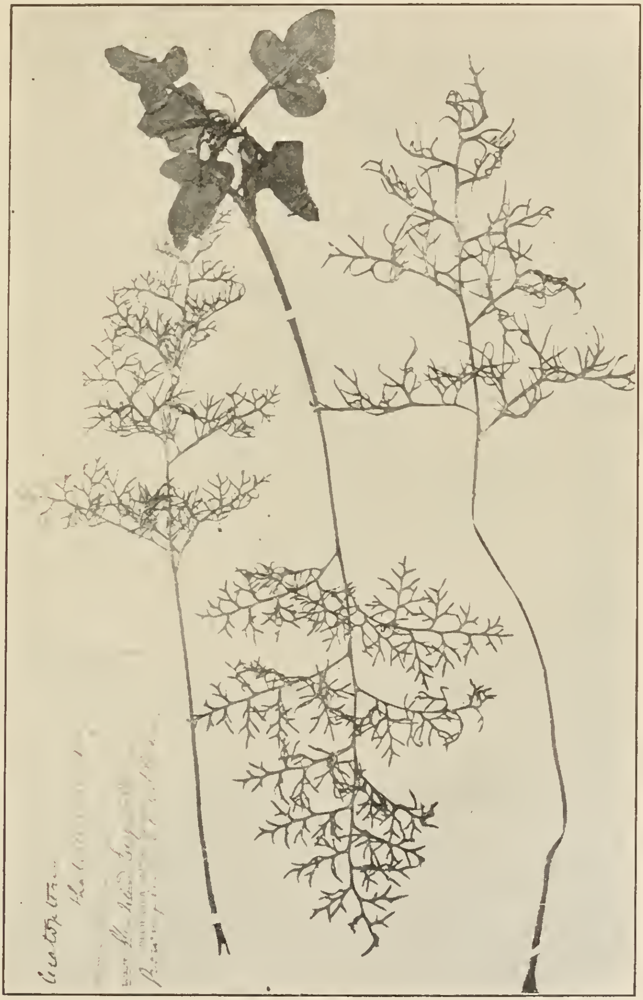

FIGURE 2. *Ceratopteris Lockharti* (Hook. & Grev.) Kunze, Glen Island, Essequibo River, Demerara, British Guiana, *Jenman*. About one third the natural size.

Type from British Guiana, Essequibo, *Parker*.

Specimens seen: British Guiana, *Parker; Jenman*, U; *Lepricur;* Brazil: *Riedel; Regnell;* Florida: *A. H. Curtiss*, St. John's River, *3690*, U, E, and N, Withlacoochee River, *5973*, N; Cuba: *Wright 3936*, E.

It is hard to understand how this very distinct species has so long been considered merely a form of the very different Old World species. Judging from the information obtainable, the two occupy entirely different habitats, the American species occurring always in the water, either floating or at least with the stem and roots submerged, the other, according to Mr. Williams' notes, only occasionally if at all in normally inundated soil. Goebel, who has seen Hooker's species growing in Guiana, states that it occurs either floating or rooting in the mud nearer shore, and that the two types differ considerably in habit. In the floating plants, the stipes are, as noted in the description, bulbous, and the leaves are all rather short. This is the form collected by A. H. Curtiss in the St. John's River, Florida, where, according to D. C. Eaton, he found it in water ten feet deep, and probably also that figured in the Engler & Prantl Pflanzenfamilien under the family Parkeriaceae. It is in this form that the sterile leaves grade into the sporophyls by insensible modifications in the shape of the ultimate segments. In the near shore form this gradation does not occur, the sporophyls are much taller than the sterile leaves, and the stipes are not bulbous. This form has been well figured by Hooker & Greville, Icones Filicum *pl. 97. f. 2*.

4. **Ceratopteris deltoidea** sp. nov.

Stem slender, rootless, the roots developed from a swollen place in the stipe a short distance from the stem: leaves alternate, successive in development, up to 65 cm. long; youngest leaves sessile or short-stalked, the lamina simple, ovate or deltoid: following leaves broadly pentagonal or deltoid, 3–7-lobed, the lobes mostly deltoid, acute, the basal division sometimes also lobed: mature sterile leaves 25–50 cm. long, the stipes 10–20 cm. long, sparsely scaly below, flattened, the lamina deltoid, acute, 20–35 cm. long, 15–25 cm. broad, pinnate-pinnatifid or 2-pinnate-pinnatifid on the lowest pinnae: pinnae broadly deltoid, 9–12 cm. long, 9–14 cm. broad, acute, oblique, the penultimate divisions cut half way to the mid-vein, the ultimate segments large and full, 3–4 cm. long, 2–3 cm.

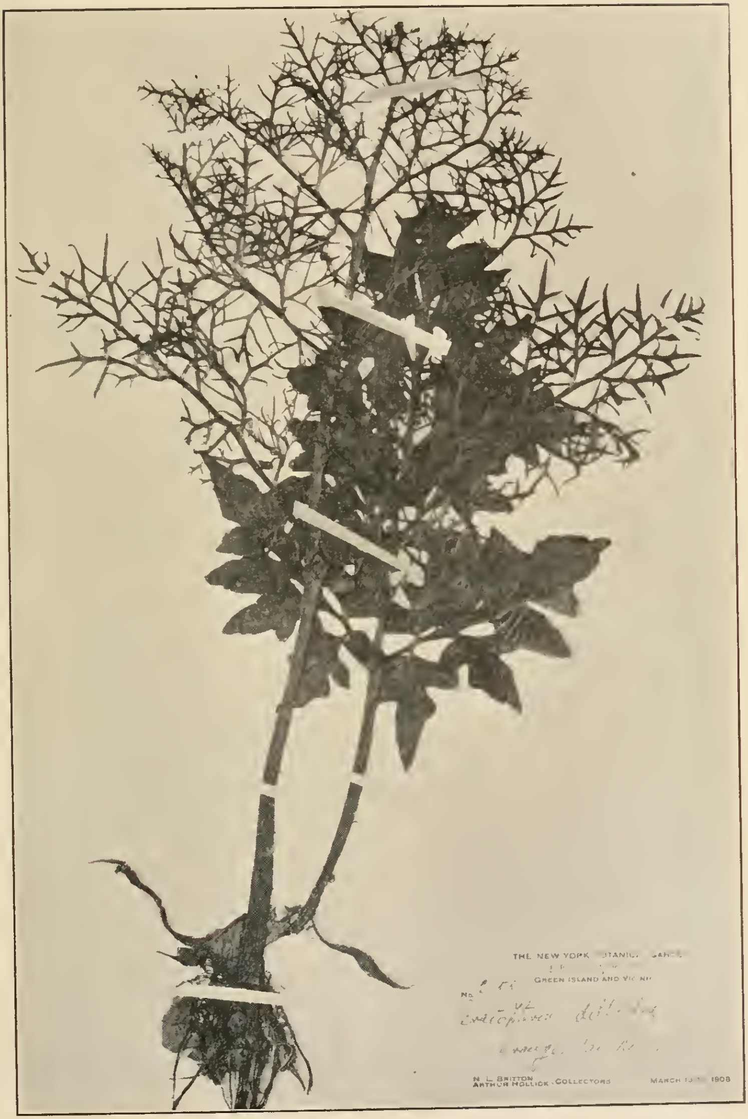
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FIGURE 3. *Ceratopteris deltoidea* Benedict, Orange Bay River, Jamaica, *N. L. Britton & Arthur Hollick 2158*. About one third the natural size.

broad, broadly deltoid, acute, the margins broadly and shallowly lobed, viviparous in the sinuses and in the axils of the larger divisions, the venation reticulate, the areolae without included veinlet, narrow: fertile leaves 40–65 cm. long, the stipes 15–20 cm. long, the lamina deltoid, 30–40 cm. long, 25–37 cm. broad, 4 times pinnately divided, the ultimate segments linear, falcate, 0.5–2 cm. long, 0.5–2 mm. broad, the ultimate and penultimate divisions viviparous in the axils, with narrow evenly revolute margins, each covering a single row of sporangia. [FIGURE 3.]

Type from Jamaica, Orange Bay River, *N. L. Britton & Arthur Hollick 2158*, 14 March, 1908, — in the Underwood Fern Herbarium. Collected at the same time and place by Harris, *no. 10,255*. Also collected in Jamaica by Jenman, Clarendon, 1874–79.

Additional material:

Porto Rico: "Coamo in fossis," 1886, *P. Sintenis 3277*, N. Consists mostly of sporophyls; ultimate segments of the sterile leaves lanceolate. Spores possibly sometimes fewer than 16 per sporangium.

Florida: *A. P. Garber*, Prairie Creek, So. Florida, July, 1878. E. (Vide D. C. Eaton, Bull. Torrey Club **6**: 264. 1878.) Only sterile leaves seen, these with somewhat narrower segments than those of the type.

Louisiana: *R. S. Cocks*, Shores of Lake Ponchartrain, rooting in mud, 1890, U. *Hasse*, in water, New Orleans, 1885, U — an imperfect specimen, with the segments narrower than in the type.

Guiana: *Jenman*, Demerara, coast lands, in trenches, 1895. U. Only sporophyls seen.

There seems at present little reason to doubt that all this material may be comprised in one species, but for the purposes of greater exactness, only the Jamaican material was considered in drawing up the above description. The only modification made necessary by the inclusion of the remaining collections is in connection with the width of the sterile segments as noted in the various citations. As far as I have seen, this is the only species in which the number of spores is typically 16 to each sporangium.

In the type locality, the Orange Bay River is, as I learn from Dr. Britton, a small clear flowing stream, a foot or two in depth. The plants grew abundantly for some distance along the river, mostly in the quieter reaches near shore, but sometimes well out in the current. The plant does not float except possibly in its juvenile stage of growth.

In the synonymy which follows, the species recognized as valid are indicated in small capitals, the names which deserve further investigation are in Roman and the straight synonyms are in italics:

CERATOPTERIS Brongn. Bull. Sci. Soc. Philom. **1821**: 186. 1821.

Teleozoma R. Br., Richardson in Franklin, Narrative of Journey, 767. 1823.

Ellobocarpus Kaulf. Enum. Fil. 147. 1824.

Parkeria Hook. Exot. Fl. **2**: *pl. 147*. 1825.

Furcaria Desv. Mém. Soc. Linn. Paris **6**: 292. 1827.

Ceratopteris cornuta Le Prieur, Ann. Sci. Nat. I. **19**: 103. *pl. 4, A*. 1830.

Pteris cornuta Pal. de Beauv. Fl. Owar. **1**: 63. *pl. 37*. 1807 (?). (Type from Wari [Owari], West Africa.)

Ellobocarpus cornutus Kaulf. Enum. Fil. 148. 1824.

Furcaria cornuta Desv. Mém. Soc. Linn. Paris **6**: 292. 1827

Onychium cornutum Hasskarl, Tijdschr. Nat. Gesch. **10**: 115. 1843.

Ceratopteris Gaudichaudii Brongn. Bull. Sci. Soc. Philom. **1821**: 186. 1821. (Type from the Marianne Islands.)

CERATOPTERIS LOCKHARTI Kunze, Linnaea **23**: 241. 1850.

Parkeria Lockharti Hook. & Grev. Ic. Fil. *pl. 97*. 1828. (Type from lakes near Arima, Trinidad.)

CERATOPTERIS PTERIDOIDES Hieronymus, Bot. Jahrb. **34**: 561. 1905.

Parkeria pteridoides Hook. Exot. Fl. **2**: *pl. 147*. 1825. (Type from British Guiana, Essequibo, *Parker*.)

Ceratopteris Parkeria J. Smith, Jour. Bot. Hook. **4**: 70. 1841.

Ceratopteris Richardii Brongn. Dict. Class. Hist. Nat. **3**: 351. 1823.

CERATOPTERIS THALICTROIDES Brongn. Bull. Sci. Soc. Philom. **1821**: 186. *f. 3, 4*. 1821.

Acrostichum thalictroides L. Sp. Pl. 1070. 1753. (Type from Ceylon.)

Acrostichum siliquosum L. Sp. Pl. 1070. 1753. (Type from Ceylon.)

Pteris thalictroides Swartz, Jour. Bot. Schrad. **4**: 651. 1801.

Pteris siliquosa Pal. de Beauv. Fl. Owar. **1**: 63. 1807 (?).

Ellobocarpus oleraceus Kaulf. Enum. Fil. 148. 1824.

Furcaria thalictroides Desv. Mém. Soc. Linn. Paris **6**: 292. 1827.

Teleozoma thalictroides R. Br., Richardson in Franklin, Narrative of Journey, 767. 1823.

Naias obvoluta Blanco,* Flora Filip. 460. 1845. [Ed. 2.]

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* I am indebted to Dr. C. B. Robinson for this reference.

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CONTRIBUTIONS FROM THE NEW YORK BOTANICAL GARDEN—No. 127

THE CRATAEGI OF MEXICO AND CENTRAL AMERICA

By W. W. EGGLESTON

NEW YORK
1909

Reprinted, without change of paging, from BULLETIN OF THE TORREY BOTANICAL CLUB 36: 501–514. 1 O 1909

[From the BULLETIN OF THE TORREY BOTANICAL CLUB, 36: 501-514 1909.]

The Crataegi of Mexico and Central America

W. W. EGGLESTON

In the autumn of 1905, Dr. C. G. Pringle sent me, from Mexico, fruiting material of what he considered a new species of *Crataegus*. Study of the literature of both the Mexican and the South American species satisfied me that he was correct in his diagnosis; but I asked him to get me flowering material from the same station. This he did in April, 1906, and *Crataegus Baroussana* was then described (Torreya 7: 35). Since then I have seen specimens of this species, *J. Gregg 433*, "mountains near Saltillo, 1848 or 49," both in the herbarium of the Missouri Botanical Garden and in the Gray Herbarium. Dr. Pringle tells me that his *C. Baroussana* ravine overlooks the battlefield of Buena Vista and therefore his station might be Dr. Gregg's as well.

The study required for this species led me to a more extensive investigation of this group as it is represented south of the Mexican boundary. I had trouble in finding important literature; many of the types were in Europe; and all of the South American species were inaccessible to me. The literature has now all been secured and a good idea of most of the types obtained, but to find material of the South American species has been a harder proposition. There is but one sheet of a South American *Crataegus* in the great herbaria of the United States. This is a flowering specimen of *C. spinosa* DC. in the herbarium of the New York Botanical Garden.

Happily, most of the South American species can easily be eliminated from the problem by their descriptions. *C. stipulosa* (H.B.K.) Steud. and *C. quitensis* Benth. were the only ones that troubled me, and a flowering specimen (from the type locality) of *C. stipulosa* and a drawing of the type of Bentham's *C. quitensis* were very kindly sent me by Lt. Col. Prain, Director of the Royal Botanic Gardens, Kew.

Dr. C. G. Pringle and Dr. Edward Palmer have made special trips in Mexico for me; and Dr. J. N. Rose, Mr. J. N. Painter, and Mr. W. R. Maxon, of the U. S. National Museum, and Mr. E. W. Nelson and Mr. E. A. Goldman of the U. S. Biological Survey have also given me information in regard to the Mexican species. In fact, without the recent work of these gentlemen in Mexico our knowledge would be very limited indeed. I have also had full access to the material in the Gray Herbarium, the National Museum, the Missouri Botanical Garden, and the Arnold Arboretum.

The first notice we have of *Crataegus* in Mexico was by Dr. F. Hernandez who resided in Mexico from about 1570 to 1580. His Nova Plantarum, Animalium et Mineralium Mexicanorum Historia was published at Rome in 1651, and his De Historia Plantarum Novae Hispaniae at Madrid in 1790.

The first definite work on the group was that of Mocino & Sessé (about the City of Mexico), but this work was not given to the world until De Candolle published the Pomaceae of his Prodomus in 1825. Baron von Humboldt found the rare *C. pubescens* (H.B.K.) Steud. in Real de Moran, Hidalgo, and published it in 1824. It seems remarkable that he should have picked up this rare and little-known species and not have observed the more common *C. mexicana* Moc. & Sessé. Around these two species and that of Bonpland's *C. stipulosa* (H.B.K.) Steud. from Ecuador, there has been a storm center ever since. One will find herbarium sheets about equally marked with these names, when as a matter of fact most of them are *C. mexicana* Moc. & Sessé.

Although the type of *Crataegus mexicana* Moc. & Sessé has not been seen, it is easy to settle the status of the species, for it was collected in the vicinity of the City of Mexico and the tracing of Mocino & Sessé's drawing is extant; this, with the fact that only one species is known near the City of Mexico seems to settle the status of *C. mexicana*. *C. stipulosa* (H.B.K.) Steud., as to description, matches very well with *C. mexicana*, but the flowering material sent from Kew seems different, and until *C. stipulosa* is well known it is better to hold to the name *C. mexicana*, although they may prove to be one species, in which case, *C. stipulosa*, being the older name, will replace the other. *C. pubescens* (H.B.K.) Steud. has been another stumbling-block. It was collected in flower by Humboldt and is finely described and figured by Kunth in the Nova Genera et Species; but flowering material of closely allied species of *Crataegi* furnishes very unsatisfactory data for determination and should be reinforced by mature fruiting material whenever possible. Dr. Rose's Jalapa plant supplied immature fruiting material for me; and last fall, Dr. Pringle collected mature fruit at Honey Station, Hidalgo (this station is within a mile or two, at least, of Humboldt's locality, Real de Moran).

My purpose in this article is to describe the wild species of Mexico and Central America but my final treatment of the group will require also a good deal of notice given to the different forms raised in and described from the various European botanical gardens. I have no evidence that either *C. pubescens* or *C. stipulosa* has ever been cultivated in botanical gardens but in the early thirties *C. mexicana* (*C. stipulacea* Lodd.) was of much interest to the English gardeners and there was some controversy at the time in regard to when and by whom it was introduced. The evidence seems to point to the fact that it must have been received in England from two sources in 1824 or a few years before that (see Gard. Mag. **9**: 496, 630; **11**: 473, 583. — G. Don, Gen. Dict. **2**: 598. — D. Don, in Sweet, Brit. Flow. Gard. **6**: 300). From England it was introduced to the continent. It does not seem to have been raised in the United States, although it might easily be grown from Washington or St. Louis south. Of the garden species *C. lobata* Bosc, *C. grandiflora* Smith, *C. Carrierei* × Carrière, *C. Lavallei* Hérincq, and *C. grignoniensis* Mouillefert, I have seen fresh fruiting material of only *C. Lavallei*; this was sent me last fall from Segrez, France, by Mr. Lavallée and might well be a hybrid between *C. mexicana* and *C. Crus-galli*, as it has been called. The colored plates of this and *C. Carrierei* are much alike and seem to me to represent practically the same form. *C. grandiflora* Smith and *C. lobata* Bosc may be Mexican species or at least partially derived from them, but these are doubtful points, needing more careful investigation. However, I have not sufficient knowledge of these species as yet, having but recently seen some of the important literature on the subject.

The genus *Crataegus*, south of the United States, seems confined to the tablelands of Mexico and southward through the highlands of the Andes. In Mexico the fruit is of much economic importance, being often found in the markets, and the trees are guarded as carefully as other fruit trees are with us.

Key to Mexican and Central American Crataegi in flower

1. Vegetative twigs, corymbs, and lower surface of leaves glabrous; leaves broadly ovate; stamens about 10; styles 4 or 5, calyx-lobes serrate; fruit red.......... *C. Baroussana.*

1. Vegetative twigs, lower surface of leaves, and corymbs tomentose... 2.

2. Leaves broadly ovate, tomentose on both sides; stamens about 10; styles 4 or 5; calyx-lobes serrate; fruit red.......... *C. Greggiana.*

2. Leaves narrower, — elliptical, lanceolate, etc.......... 3.

3. Stamens 5–10; styles 3 or 4; calyx-lobes serrate; fruit red.......... *C. Rosei.*

3. Stamens about 20.......... 4.

4. Calyx-lobes serrate, styles usually 2 or 3; fruit yellow. *C. pubescens.*

4. Calyx lobes entire.......... 5.

5. Leaves oblanceolate.......... *C. stipulosa.*

5. Leaves lanceolate, elliptical, etc.......... 6.

6. Styles 2–3; leaves glabrous above; fruit yellow.......... *C. Parryana.*

6. Styles 3–5, leaves tomentose above.......... 7.

7. Leaves 3–9 cm. long, styles usually 3 or 4; fruit orange.......... *C. mexicana.*

7. Leaves 1.5–5 cm. long; styles usually 4 or 5.......... *C. Nelsoni.*

Key to Mexican and Central American Crataegi in fruit

1. Vegetative twigs glabrous.......... *C. Baroussana*

1. Vegetative twigs tomentose.......... 2.

2. Leaves broadly ovate.......... *C. Greggiana.*

2. Leaves elliptical, etc.......... 3.

3. Fruit large, 15–30 mm. thick.......... 4.

3. Fruit small, 8–15 mm. thick.......... 5.

4. Leaves oblanceolate.......... *C. stipulosa.*

4. Leaves lanceolate, etc.......... 6.

6. Nutlets 3–5; calyx-lobes erect, entire; fruit orange.......... *C. mexicana.*

6. Nutlets 2 or 3; calyx-lobes reflexed, glandular-serrate; fruit light yellow.......... *C. pubescens.*

5. Nutlets 2 or 3; fruit yellow; calyx-lobes entire.......... *C. Parryana.*

5. Nutlets 3 or 4; fruit red; calyx-lobes serrate.......... *C. Rosei.*

5. Nutlets 4 or 5; calyx-lobes entire.......... *C. Nelsoni.*

CRATAEGUS PUBESCENS (H.B.K.) Steud. Nom. Bot. 433. 1841 [ed. 2]

Mespilus pubescens H.B.K. Nov. Gen. et Sp. **6**: 213. *pl. 565*. 1824.

Leaves 1–7.5 cm. long, 0.8–4 cm. wide, rhomboid-elliptical to ovate or sometimes obovate or spatulate, often one-sided towards the base, serrate or crenate-serrate, often doubly so, with gland-tipped teeth, leaves of the vegetative shoots often three-lobed towards the apex and extremely variable as to size, acute at the apex, cuneate at base, subcoriaceous, slightly appressed-pubescent and impressed-veined above when young, bright green becoming nearly glabrous above when mature, paler and tomentose below; petioles 2–10 mm. long, slightly winged and pubescent; stipules falcate to half-ovate, strongly glandular-serrate, fugacious; corymbs 6–10 flowered, tomentose, flowers 10–12 mm. wide, the lanceolate acute strongly glandular-serrate calyx-lobes nearly glabrous; stamens about 20; styles usually 2 or 3, occasionally 4; fruit compressed-globose to globose, light straw-colored (according to Pringle), 15–25 mm. thick; calyx-lobes reflexed, mostly deciduous; flesh light yellow; nutlets 2–4, strongly ridged on the back, 8–10 mm. long, nest of nutlets 10–12 mm. thick. Young twigs slightly tomentose becoming glabrous, light chestnut-brown. Thorns 1–3 cm. long, slender, straight, frequent. Habit of the common apple tree, sometimes 10 m. high.

This species has been infrequently found in the moister region (1000–3000 m.) of the eastern border of the tableland, ranging from Hidalgo southwards.

Type locality, Real de Moran, State of Hidalgo (2420 m.), *Humboldt*.

Specimens examined:

Jalapa, Vera Cruz, *C. J. W. Schiede*, 1828. (Herb. Columbia Univ. and Gray Herb.)

Jalapa, *C. L. Smith 1484*, Apr. 11, 1894, 6900 ft. (Gray Herb.)

Jalapa, *C. G. Pringle 8081*, Mar. 30, 1899.

Jalapa, *J. N. Rose & W. Hough 4250*, May 17–22, 1899. (Herb. U. S. Nat. Museum and herb. N. Y. Bot. Gard.)

Honey Station, Hidalgo, *C. G. Pringle*, Oct. 22, 1908. (Herb. N. Y. Bot. Gard.)

The next number probably belongs to this species:

E. W. Nelson 1334, eighteen miles southwest of city of Oaxaca, Sept. 10–20, 1897. (Gray Herb. and herb. U. S. Nat. Mus.)

Crataegus pubescens Botterii var. nov.

Leaves shorter than those of the type, tomentose above, more rugose than in the type, densely white-tomentose; corymbs densely white-tomentose.

This may prove a distinct species when better known.

Type: *Botteri 1121*. (Gray Herb.)

Specimens examined:

Orizaba, *Botteri 1121*, about 1850. (Herb. U. S. Nat. Mus. and Gray Herb.)

Huatasco, Vera Cruz, *C. Mohr*, 1856. (Mohr Herb., U. S. Nat. Mus.)

Eugenio, Rincón de la Carbonera, Orizaba, *F. Müller*, 1853. (Herb. Columbia Univ.)

Boca del Monte, Orizaba, *E. W. Nelson 218*, May 13, 1894. (Herb. U. S. Nat. Mus.)

CRATAEGUS MEXICANA Moc. & Sessé; DC. Prod. **2**: 629. 1825. — Moc. & Sessé, Dessins Fl. Mex. *pl. 299*. 1874. — Bot. Reg. **22**: *pl. 1910*. 1836. — Loudon, Arb. et Frut. Brit. **2**: 843, 867; **6**: 156. 1838. — D. Don in Sweet, Brit. Flow. Gard. **6**: *pl. 300*. 1835

C. subserrata Benth. Plantae Hartweg. 10. 1839.

C. hypolasia K. Koch, Hort. Dend. 167. 1853.

Leaves elliptical-lanceolate or oblanceolate, 3–9 cm. long, 1.5–4 cm. wide, serrate-crenate, with gland-tipped teeth, sometimes slightly lobed towards the apex, often irregularly so or the margin repand, entire towards the base, obtuse or acute at the apex, cuneate at the base, dull, coriaceous, tomentose above, sometimes becoming nearly glabrous, impressed-veined and slightly corrugated; tomentose below, particularly along the veins; petioles 5–10 mm. long, slightly winged, tomentose; corymbs 4–10-flowered, densely white-tomentose; flowers 15–20 mm. wide; calyx-lobes less tomentose, about 6 mm. long, lanceolate, entire except at the apex, which is usually obtuse and often has two to four nearly equal gland-tipped teeth; stamens about 20, anthers pink, styles 3–5, densely tomentose about the base; fruit ovoid, short-ellipsoidal or short-pyriform, 15–25 mm. thick, edible, orange or rusty orange, calyx-lobes erect, thickened at the base;

nutlets 3–5, broadly ridged on the back, obtuse at the ends, 8–10 mm. long, nest of nutlets 10–12 mm. thick. A small tree sometimes 10 m. high, resembling the common apple tree in habit. Young twigs tomentose. Thorns often wanting or trees occasionally armed with short thorns.

A tree of the higher altitudes (1000–3000 m.) of the central tableland, ranging from central Mexico (San Luis Potosi, *Parry & Palmer 228*) southward.

Type station, vicinity of the City of Mexico, *Mocino & Sessé.*

Specimens examined:

C. G. Pringle 13736, Eslava, Federal District, Mexico, 7800 feet, Mar. 22, 1906. Tree 15–25 feet. Also fruit from this station, Nov. 7, 1907. (Herb. N. Y. Bot. Gard.)

C. G. Pringle 6547, base of Sierra de Ajusco, Federal District, Mexico, 7800 feet, Sept. 29, 1896.

C. G. Pringle 6631, river banks near Tula, Hidalgo, 6800 feet, June 15, 1897.

C. G. Pringle 6983, fields about Tepoxtlan, Morelos, Mexico, 7500 feet, Mar. 15, 1899. A large tree.

C. G. Pringle 11400, Eslava, State of Mexico, 8000 feet, Sept. 17, 1903.

C. G. Pringle 1467, Marquess, State of Mexico, 8000 feet, Apr. 20, 1887.

J. Gregg 618 and *618b*, valley and hills below Real del Monte, Mexico, 1848–49.

Graham, Mexico. (Gray Herb.)

Herb. de la Commission Scientifique du Méxique *50*. Santa Fé près México.

J. G. Schaffner Herb. San Luis Potosi, May, 1881. (Gray Herb.)

Parry & Palmer 228, San Luis Potosi, 1878.

E. Palmer, San Luis Potosi mountains, 1878.

Rose & Painter 7118, Eslava, Valley of Mexico, Sept. 17, 1903.

Rose & Painter 7894, Nevada de Toluca, State of Mexico, Oct. 15, 1903.

Rose, Painter, & Rose 9483 and *9484*, San Angel, Valley of Mexico, Aug. 15, 1905.

Rose & Hough 4532, near Tlalpam, Valley of Mexico, June 9, 1899.

Rose & Hough 4710, between Tepeaca and Santa Rosa, Pueblo, Mexico, June 27, 1899.

Rose & Hay 5293, near Dublan, Hidalgo, Mexico, July 2, 1901.

W. Trelease 40, above Malhalla, Vera Cruz, Mexico, Feb. 19, 1905.

C. subserrata Benth., *Hartweg 47*, Mexico, as seen in the Gray Herbarium, seems to represent a rather entire-leaved form of *C. mexicana*, which, as to the Gray Herbarium specimen, is not worthy of even a varietal name.

Crataegus mexicana microsperma var. nov.

C. pubescens Watson, Proc. Am. Acad. **22**: 396. 1887. Not *Mespilus pubescens* H. B. K.

Leaves narrower than those of the type; fruit pyriform, yellow, with red cheeks, 10–15 mm. thick; nutlets 3–5, about 6 mm. long, grooved on the back, with calyx-scar, nest of nutlets 7–8 mm. thick.

This may prove a good species.

Type, *E. Palmer 465*, Guadalajara, Jalisco, Mexico, Sept., 1886.

The following numbers also I would refer here:

E. W. Nelson 553, west slope of Mt. Zempoaltepec, Oaxaca, Mexico, 7700–8000 feet, July 5–13, 1894.

E. W. Nelson 4092, roadside between San Sebastian and the summit of the mountain known as the Bufa de Mascote, Jalisco, Mexico, 7200 feet, Mar. 20, 1897.

M. E. Jones 136, Chiquilistlan, Jalisco, Mexico, June 1, 1892.

I doubtfully refer the following numbers to this variety:

E. W. Nelson 6555, Patamban, Michoacan, Mexico, 6500–8500 feet, Jan. 27, 28, 1903.

E. Langlassé 45, Village du Durarno, Michoacan et Guerrero, Mexico, Mar. 20, 1899.

Of no. 465 Dr. Palmer says, "Twenty feet high; fruit yellow with black dots, and often a red blush on one side, Guadalajara; September (465). *Tejocote*, a jelly, is made from the fruit, resembling that from the quince."

CRATAEGUS STIPULOSA (H.B.K.) Steud. Nom. Bot. 433. 1841 [ed. 2]

Mespilus stipulosa H.B.K. Nov. Gen. et Sp. **6**: 213. 1824.

Material from Gautemala matches this species better than any other I have seen. The leaves are oblong or obovate-oblong, tomentose, acute at the apex, cuneate at the base, crenate-serrate, tomentose; corymbs densely white-tomentose, few-flowered; stamens about 20; fruit globose or short-pyriform, (yellow?), 15–30 mm. thick, calyx deciduous; nutlets 2–4.

Specimens examined:

J. D. Smith 2531, Las Delicias, Depart. Sacatepéquez, Guatemala, 7000 feet, Mar. 1892.

Heyde & Lux 3324, Santa Rosa, Depart. Santa Rosa, Guatemala, 4000 feet, Apr. 1892.

W. A. Kellerman 7071, Volcano Agua, Depart. Sacatepéquez, Guatemala, 9000 feet, Feb. 4, 1908.

W. A. Kellerman 4529, Volcano Agua, Guatemala, Feb. 18, 1905.

Maxon & Hay 3668, Volcano Agua, Guatemala, 1800 m., Mar. 21, 1905.

W. R. Maxon, fruit bought in the market of Mazatenango, Guatemala, Feb. 1905.

The following I would refer to this species with some doubt:

E. W. Nelson 3162, near San Cristobal, Chiapas, Mexico, 7000–8800 feet, Sept. 18, 1895.

E. A. Goldman 941, Teopisca, Chiapas, Mexico, May 7, 1894.

Crataegus Rosei sp. nov.

Leaves short-spatulate to obovate, obtuse at the apex, cuneate at the base, serrate-creneate with fine teeth, slightly pubescent along the veins, finely rugose, shining, yellow-green above, paler and tomentose along the veins below; petioles 5–10 mm. long, slightly winged, pubescent, stipules of the vegetative twigs semilunate, 3–4 mm. long, glandular-serrate; corymbs 3–9-flowered, whitish-villose; flowers 12–15 mm. wide, calyx and lobes slightly villose, calyx-lobes remotely serrate or entire, lanceolate, acute, 2–3 mm. long; stamens 5–10; styles 2–4, surrounded at the base by a dense tuft of tomentum; fruit ellipsoidal or pyriform, red, 8–12 mm. thick, slightly villose, flesh soft, calyx-lobes reflexed or spreading, nutlets usually 3, strongly ridged on the back, 6–7 mm. long, nest of nutlets 8–9 mm. thick. Vegetative twigs villose, yellow-green, becoming glabrous and ash-gray, armed with chestnut-brown, slightly curved spines 2–4 cm. long.

Type *E. Palmer 74*, Alvarez, San Luis Potosi, Mexico, Sept. 5–10, 1902. (Herb. N. Y. Bot. Gard.).

Of no. 74 Dr. Palmer says, " *Tejocote colorado.* The fruits are sold in San Luis Potosi for making *cayata*. A small tree; 15 feet may cover the height of the tallest. It has the habit of the hawthorn with an immense crop of fruit which is eaten raw by the people."

Of no. 47, "Small tree like the hawthorn of the United States, very thorny; the fruits are edible, very productive; of the general height of 10–15 feet, very bushy, known as *Tejocote;* the fruit hangs on the tree a long time."

Of no. 229, "*Tejocote*, one of the most useful trees found here, has a thick compact top of dark green leaves that have a fine polish, thus enabling it to stand dryness, is loaded with fruit. The wood is white, tough and durable, used for handles of tools; the fruits are of a red color, are eaten raw and made into preserves and jelly. Height 20–30 feet and diameter 6–15 inches, flowers white and sweet-scented, found in secluded nooks in ravines or by mountains near water-courses."

Specimens examined:

E. Palmer 74. (Herb. N. Y. Bot. Gard., Gray Herb., herb. U. S. Nat. Mus. and herb. Arn. Arbor.)

E. Palmer 47, Santiago Papasquiaro, Durango, Mexico, Apr., 1896. (Herb. N. Y. Bot. Gard., Gray Herb., herb. U. S. Nat. Mus., herb. Arn. Arbor.)

E. Palmer 229, Tobar, Durango, Mexico, May 28–31, 1909. (Herb. N. Y. Bot. Gard. and herb. U. S. Nat. Mus.)

E. Palmer 333, vicinity of Chihuahua, Mexico, June 5–10, 1908. (Herb. U. S. Nat. Mus. and herb. N. Y. Bot. Gard.)

E. W. Nelson 4673, Papasquiaro, Durango, Mexico, Aug. 7, 1898. (Herb. U. S. Nat. Mus.)

This species of the interior plateau seems to take the place of *C. mexicana* in northern Mexico. It will be surprising if it is not found in southern New Mexico and Arizona.

Crataegus Parryana sp. nov.

Leaves 1.5–4 cm. long, 1–3 cm. wide, oblong-rhomboidal to elliptical-ovate, serrate nearly to the base, sometimes doubly serrate, with gland-tipped teeth, coriaceous, bright yellow-green, glabrous, rugose, impressed-veined above, paler and strongly tomentose along the midrib below, acute at the apex, cuneate at the base; petioles 2–5 mm. long, slightly pubescent; corymbs few-flowered

(2–4-fruited), pedicels slightly whitish tomentose; fruit yellow, compressed-globose, 12–18 mm. thick, slightly pubescent; calyx-lobes appressed, lanceolate, acute, slightly tomentose; stamens about 20, tomentose about the base; nutlets 2 or 3, obtuse, strongly ridged on the back, 7–9 mm. long, nest of nutlets 8–10 mm. thick. Young twigs light chestnut-brown, slightly pubescent, becoming gray and glabrous. Thorns numerous, at first chestnut-brown, 2–4.5 cm. long, nearly straight. In habit like the apple or the hawthorn.

Type, *E. Palmer 75*, Alvarez, San Luis Potosi, Mexico, Sept. 5–10, 1902. (Herb. U. S. Nat. Mus.)

Of this number Dr. Palmer says. "*Tejocote ameco.* The fruit of this form is sometimes a little larger than no. 74 [*C. Rosei*], and if it can be a larger crop of fruit. Has a fine odor. A small tree; 15 feet may cover the height of the tallest. It has the habit of the hawthorn. Quite thorny. May not the cultivated yellow ones of San Luis Potosi originate here?" He also told me that the locality where he found this species and no. 74, in the mountains about twenty miles southeast of the city of San Luis Potosi, had the greatest number of individual trees of any place he had seen, and was also the only place that he would be sure that *Crataegus* was wild in Mexico.

Dr. Pringle, however, says that although *Crataegus* is frequently cultivated in the Mexican gardens, still a great many of the seemingly cultivated trees are undoubtedly in their native habitats.

Crataegus Greggiana sp. nov.

C. pubescens Watson, Proc. Am. Acad. 17: 354. 1882. Not *Mespilus pubescens* H.B.K.

Leaves 2–7.5 cm. long, 2–6 cm. wide, broadly ovate to elliptical-ovate, tomentose on both sides, becoming scabrous above, finely and doubly serrate, or lobed towards the apex, with often irregular lobes, acute or obtuse at the apex, broadly cuneate at the base, subcoriaceous, dull; petioles 5 mm. long, tomentose; corymbs 4–8-flowered, corymbs and calyx densely white-tomentose, calyx-lobes lanceolate, acuminate, remotely and irregularly serrate, about 6 mm. long; stamens about 10; styles 3–5; fruit brick-red, about 10–12 mm. thick, globose, tomentose; calyx-lobes appressed, persistent; nutlets usually 4 or 5, grooved on the back, with a conspicuous calyx-scar, 6–7 mm. long, nest of nutlets 7–9 mm. thick. Twigs tomentose, becoming glabrous. Thorns numerous, straight, slender, chestnut-brown, 3–6 cm. long.

Type, *E. Palmer 300*, Saltillo, Coahuila, Mexico, Sept., 1898. (Gray Herb.)

Description of flowers drawn from *E. Palmer 2123*, Mts. 6 miles east of Saltillo, Apr. 15–20, 1880. (Gray Herb.)

"Garden spots, low hills and little hollows between hills, common. No. 300, hawthorn, prolific bearer of brick-red fruit, edible, sold in the market; the pulp has an apple taste; 15–20 feet high, symmetrical top, rough bark, many long thorns, six inches to one foot in diameter, the seeds are taken out of the top of the fruit, which is cooked in sugar and forms a fine preserve."

Specimens examined:

E. Palmer 300. (Gray Herb., herb. N. Y. Bot. Gard., herb. U. S. Nat. Mus., and herb. Arn. Arbor.)

E. Palmer 704, Saltillo, July 28, 1905. (Herb. N. Y. Bot. Gard. and herb. U. S. Nat. Mus.)

E. W. Nelson 6729, General Cépida, Coahuila, Mexico, Apr. 20, 1902. (Herb. U. S. Nat. Mus.)

Crataegus Nelsoni sp. nov.

Leaves 1.5–5 cm. long, 1.5–4 cm. wide, elliptical-ovate to obovate, acute at the apex, cuneate at the base, serrate or doubly serrate, somewhat tomentose below, finely rugose and slightly pubescent above, subcoriaceous; petioles less than 5 mm. long, slightly pubescent; corymbs 3- or 4-fruited, pedicels slightly pubescent; fruit globose, 10–15 mm. thick, slightly pubescent, stamens about 20, calyx-lobes persistent and appressed, entire, slightly pubescent; nutlets 4 or 5, grooved on the back, 7–9 mm. long, nest of nutlets 9–11 mm. thick. Vegetative twigs somewhat pubescent. Thorns very numerous, 3–5 cm. long.

Type, *E. W. Nelson 3217*, near San Cristobal, Chiapas, Mexico, alt. 7000–8800 feet, Sept. 19, 1895. (Herb. U. S. Nat. Mus.)

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Bibliography of Mexican and Central American Crataegi

Beck von Mannagetta, G. *Cotoneaster sikkimensis* und *Crataegus grignoniensis*. Wien. Gart. Zeit. **15**: 248. 1890.

Bentham, G. Plantae Hartwegianae 10, 173. 1839.

Bosc, L. A. G. Nouv. cours. agri. **2**: 233. 1821.

Candolle, A. P. de. Prodromus systematis naturalis regni vegetabilis **2**: 626, 628, 629. 1825.

Carrière, E. A. *Crataegus Carrierei.* Rev. Hort. **55**: 108. 1883. [With colored plate.]

Desfontaines, R. L. Tableau de l'école de botanique du Jardin du Roi 271. 1815. [Ed. 2.]

Desfontaines, R. L. Catalogus plantarum horti regii parisiensis 289, 469. 1829. [Ed. 3.]

Don, D. *Crataegus mexicana.* Sweet, British flower garden **6**: *pl. 300.* 1835.

Don, G. General history of the dichlamydeous plants **2**: 598, 599, 601. 1832.

Eggleston, W. W. New North American Crataegi. Torreya **7**: 35. 1907.

Heller, K. B. Reisen in Mexiko, 1845–48, 429. 1853.

Hemsley, W. B. Biologia centrali-americana **1**: 379. 1880.

Hernandez, F. Nova plantarum, animalium et mineralium mexicanorum historia 85, 97. 1651.

Hernandez, F. De historia plantarum Novae Hispaniae **2**: 508–510. 1790.

Humboldt, Bonpland, & Kunth. Nova genera et species plantarum **6**: 213. *pl. 565.* 1824.

Koch, K. Hortus dendrologicus 167, 172. 1853.

Koch, K. Weissdorn und Mespil-Arten. Verh. Ver. Bef. Gartenb. II. **1**: 299. 1853.

Koch, K. Weissdorn und Mespil-Arten 8–10, 14, 77–79, 84. 1854. [Separate.]

Koch, K. Dendrologie **1**: 132–134. 1869.

Lambert, A. B. Gardener's Mag. **11**: 583. 1835.

Lange, J. Revisio specierum generis Crataegi 75, 91. 1897.

Laundy, H. The species of hawthorn from South America, similar to the British kind, only an evergreen. Gardener's Mag. **9**: 630. 1833.

Lavallée, A. Arboretum segrezianum: icones selectae arborum et fruticum in hortis segrezianis collectorum 21. *pl. 7.* [1881.]

Lindley, J. *Crataegus mexicana.* Bot. Reg. **20**: *pl. 1910.* 1836.

Loudon, J. C. Gardener's Mag. **11**: 473, 583. 1835.

Loudon, J. C. Arboretum et fruticetum britannicum **2**: 843, 867; **6**: 156. 1838.

Mocino, J. M., & Sessé, M. Dessins de la flore du Méxique *pl. 299.* 1874.

Mocino, J. M., & Sessé, M. Plantae Novae Hispaniae 78, 79. 1887.

Mocino, J. M., & Sessé, M. Flora mexicana 125, 126. 1887–90.

Nicholson, G. Illustrated dictionary of gardening **1**: 393. 1884; Supplement **1**: 264, 265. 1900.

Poiret, J. L. M. Encyclopédie méthodique. Botanique. Supplément **4**: 72. 1816.

Presl, K. B. Epimeliae botanicae 203, 204. 1851. [Peru.]

Ramírez, J., *and others.* Datos para la materia médica mexicana **3**: 1. *pl.* 1900.

Ramírez, J. Sinonimia vulgar y cientifica de las plantas mexicanas 67, 91. 1902.

Regel, E. Revisio specierum generis Crataegi. Act. Hort. Petrop. **1**: 107, 124. 1871.

Rehder, A. Bailey, Cyclopedia of American horticulture **1**: 395, 397. 1900.

Roemer, M. J. Synopses monographicae **3**: 115, 116, 142, 150, 154. 1847.

Schlechtendal, D. de, & Chamisso, A. de. Plantarum mexicanarum a cel. viris Schiede et Deppe collectarum recensio brevis. Linnaea **5**: 574. 1830.

Schlechtendal, D. F. L. de. Plantae Lechlerianae. Linnaea **28**: 466–469. 1856. [Peru.]

Schneider, C. K. Illustriertes Handbuch der Laubholzkunde 794. 1906.

Smith, J. E. Exotic botany **1**: 33. *pl. 18.* 1804.

Spach, E. Histoire naturelle des végétaux **2**: 54. 1834.

Steudel, E. G. Nomenclator botanicus 433, 434. 1841. [Ed 2.]

Taylor, S. A species of hawthorn from South America, similar to the British kind, only an evergreen. Gardener's Mag. **9**: 496. 1833.

Urbina, M. Catálogo de plantas mexicanas 82. 1897.

Warscewicz, J. [Journey to La Paz, Bolivia, 1852.] Otto & Dietr. Allg. Gartenz. **20**: 292. 1852.

Watson, S. List of plants from southwestern Texas and northern Mexico, collected chiefly by Dr. E. Palmer in 1879–80. — I. Polypetalae. Proc. Amer. Acad. **17**: 354. 1882.

Watson, S. List of plants collected by Dr. Edward Palmer in the State of Jalisco, Mexico, in 1886. Proc. Amer. Acad. **22**: 411. 1887.

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GARDEN—No. 128

STUDIES ON THE ROCKY MOUNTAIN FLORA—XIX

By PER AXEL RYDBERG

NEW YORK
1909

Reprinted, without change of paging, from BULLETIN OF THE TORREY BOTANICAL CLUB 36:
531-541. 1 O 1909

From the Bulletin of the Torrey Botanical Club, 36: 531-541. 1909

Studies on the Rocky Mountain flora — XIX

Per Axel Rydberg

Muhlenbergia squarrosa (Trin.) comb. nov.

Vilfa squarrosa Trin. Mém. Acad. Pétersb. VI. Sci. Nat. 5^2: 100. 1840.

Vilfa depauperata Torr. in Hook. Fl. Bor.-Am. **2**: 257. 1840. Not *Muhlenbergia depauperata* Scribn. 1884.

Sporobolus depauperatus Scribn. Bull. Torrey Club **10**: 63. 1883.

The group of grasses which Torrey, Trinius, and Thurber included under the generic name *Vilfa* has been transferred from *Sporobolus* to *Muhlenbergia*. See Bull. Torrey Club **32**: 599, 600. As this species is a member of that group, it also should be transferred. It is doubtful which of the two specific names, *squarrosa* or *depauperata* is the older, but the latter is not available, as there is already a *Muhlenbergia depauperata* Scribn.

Agrostis atrata sp. nov.

A somewhat tufted perennial; stems 1.5–3 dm. high, few-leaved, more or less bulbous at the base; sheaths glabrous, shorter than the internodes; ligules ovate, 1.5–2.5 mm. long; leaf-blades 5–10 cm. long, about 2 mm. wide, flat, smooth; panicle 5–8 cm. long, rather open; branches ascending, the lower ones 2–3 cm. long; spikelets dark purple, about 2 mm. long; empty glumes nearly equal, abruptly acute or acuminate; flowering glume nearly as long, obtusish; palet slightly shorter and more than half as broad.

The type number of this species was determined by Professor A. S. Hitchcock as *A. Thurberiana*, but it differs from that species in the following respects: The empty glumes are dark purple as in *A. aequivalvis*, abruptly acute or acuminate; the inflorescence is short and open and the stem is few-leaved. In *A. Thurberiana* the empty glumes are green, only tinged with purple at the apex, narrowly lanceolate and gradually acute; the inflorescence is long and narrow, and the stem is very leafy. It differs from *A. aequivalvis* in the smaller spikelets, only 2 mm. long, instead of 3 mm., and the shorter rachilla, which is barely one third as long as the flower.

British Columbia: Yoho Valley, Sept. 6, 1904, *John Macoun 64787* (type, in herb. N. Y. Bot. Gard.); also *64788;* Selkirk Mountains, 1904, *C. H. Shaw 424;* Roger's Pass, July 31, 1890, *John Macoun.*

Agrostis Bakeri sp. nov.

A cespitose perennial; stem about 3 dm. high, erect, slightly geniculate below, glabrous; basal leaves numerous; sheaths close, slightly scabrous, those of the stem-leaves often shorter than the internodes, ligules ovate, 2 mm. long, dentate; leaf-blades flat, 1–2 mm. wide, 5–10 cm. long; panicle ovoid, 8–10 cm. long, open; branches ascending, branched above the middle, the lower 3–5 cm. long; pedicels somewhat scabrous, thickened below the spikelets; empty glumes nearly equal, purple, 2–2.5 mm. long, acuminate; flowering glume three fourths as long, obtuse, bearing above the middle a dorsal straight awn a little exceeding the glume; palet none or minute.

The type specimen of this species was determined as *A. tenuis erecta* by Professor Scribner and included by Professor Hitchcock in *A. idahoensis* (the latter united *A. idahoensis* Nash and *A. tenuis* Vasey). Professor Hitchcock remarked that Baker's *no. 150* "is yet more robust and there is a short straight awn on the flowering glume." These are the essential characters by which it is to be separated from *A. idahoensis.* The empty glumes are also larger and more acuminate. One of the other specimens referred to *Agrostis Bakeri*, viz. *no. 37*, was included in *A. hiemalis geminata* by Hitchcock. Of this he remarked that it has "the awn but a more diffuse panicle." It is evident that Baker's *no. 37* and *no. 150* belong to the same species, the former being younger and less well developed. *Agrostis Bakeri* is most closely related to *A. geminata* Trin., differing in the broader leaves, ascending instead of divaricate branches of the panicle, smaller spikelets, and shorter awns. In *A. geminata* the basal leaves are filiform and involute, the spikelets about 3 mm. long and the awn equaling the empty glumes. *A. Bakeri* grows in the mountains at an altitude of 3000–3200 m.

Colorado: Near Pagosa Peak, August, 1899, *C. F. Baker 150* (type, in herb. N. Y. Bot. Gard.); *no. 37* and *no. 148.*

Deschampsia confinis (Vasey) sp. nov.

Deschampsia caespitosa confinis Vasey; Beal, Grasses N. Am. 2: 369. 1896.

The only character given by Professor Beal is the unusual length of the ligules. To this should be added a narrow inflorescence with strongly ascending branches and a long awn inserted near the base of the floral glume. I think that these characters make the plant specifically distinct from *D. caespitosa*. *D. confinis* ranges from southern Utah and Arizona to southern California.

Sphenopholis intermedia (Rydb.) comb. nov.

Koeleria truncata major Torr. Fl. U. S. **1**: 117. 1824.
Eatonia intermedia Rydb. Bull. Torrey Club **32**: 602. 1905.
Sphenopholis pallens major Scribn. Rhodora **8**: 145. 1906.

Poa callida sp. nov.

Perennial, with a creeping rootstock; stem 3–5 dm. high, somewhat flexuose, striate and glabrous; ligules lanceolate, long-attenuate, 5–6 mm. long; leaf-blades flat, flaccid, 5–12 cm. long, about 3 mm. wide, smooth; sheaths exceeding the internodes; panicle open, 1–1.5 dm. long; branches spreading or reflexed, scabrous; the lower ones in 4's to 6's, 5–7 cm. long, spikelet-bearing above the middle; spikelets about 3 mm. long, 2- or 3-flowered, light green, strongly compressed; first empty glume subulate, 1-nerved, 2 mm. long; the second slightly broader, 3-nerved, 2.5 mm. long, glabrous; floral glumes 3 mm. long, strongly 5-nerved, acuminate, glabrous except the keel, which is slightly silky below; cobweb scant but long.

This species is related to *Poa occidentalis* Vasey, but is a weaker and more flaccid plant, has very long and conspicuous ligules, narrow flowering glumes, which are still more strongly nerved. The spikelets resemble those of *P. nervosa*, but are smaller; the floral glumes are smooth and with a distinct cobweb. The type was named *P. serotina*, which also it resembles, but in that species the floral glumes are less compressed, with obsolete intermediate nerves.

MONTANA: Warm Springs, Helena, July 13, 1895, *Rydberg 2145* (type, in herb. Columbia Univ.).

Poa scaberrima sp. nov.

A tufted perennial, with numerous intravaginal innovations; stem 3–5 dm. high, 2- or 3-leaved, glabrous; ligules lanceolate, acuminate; leaf-blades filiform, involute, very scabrous, pale green; blades of the basal leaves 8–15 cm. long, less than 1 mm. wide; those of the stem-leaves 1–5 cm. long, erect; panicle elliptic, dense, 4–7 cm. long; branches short, strongly ascending; spikelets about 1 cm. long; empty glumes ovate, nearly equal, 4–5 mm. long, glabrous; floral glumes ovate, acuminate, pale, slightly tinged with purple, 5–6 mm. long, strongly 5-nerved, and conspicuously scabrous.

The type was named by Professor Scribner *Poa Cusickii*, from which it differs, however, in the larger, paler, very scabrous, acuminate floral glumes and the pale scabrous filiform leaves. In habit it more resembles *P. idahoensis* and *P. subaristata*. From the former it differs in the dense inflorescence and broader glumes; from the latter in the broader glumes and the lanceolate ligules.

IDAHO: Beaver Cañon, June 27, 1895, *Rydberg 2055* (type, in herb. N. Y. Bot. Gard.).

Poa Helleri sp. nov.

A tufted perennial; stem slender, 4–6 dm. high, often purple-tinged below; ligules lanceolate, acuminate; leaf-blades very slender, flaccid, 5–15 cm. long, 1 mm. wide, more or less involute, scabrous; panicle rather loose, 8–10 cm. long; branches ascending; spikelets about 1 cm. long, 4- or 5-flowered; empty glumes linear-lanceolate, 3-nerved, glabrous, unequal, 4–5 mm. long; floral glumes linear-lanceolate, about 5 mm. long, strigulose below, scabrous on the upper part.

The type was named *Poa Sandbergii*, but it can scarcely be referred to that species. It differs in the pale inflorescence, larger and much narrower, conspicuously strigose floral glumes. In habit it resembles *P. idahoensis*, but evidently belongs to the same group as *P. nevadensis*, from which it differs in the slender habit and the narrower glumes with a different pubescence.

IDAHO: Lake Waha, *A. A. & E. Gertrude Heller 3274* (type, in herb. Columbia Univ.).

Poa curta sp. nov.

Perennial, with a horizontal rootstock; stem glabrous, 4–5 dm. high; sheaths short, glabrous; ligules about 1 mm. long, truncate;

leaf-blades 2–5 cm. long, 3–5 mm. wide, abruptly acute, spreading, dark green; inflorescence short, open, 4–5 cm. long; branches in 2's to 4's, spreading, 1–2 cm. long, spikelet-bearing above the middle; spikelets light green, strongly compressed, about 6 mm. long, 2–4-flowered; empty glumes glabrous, but scabrous on the veins, lanceolate, the first 3 mm. long, 1-nerved, the second 4 mm. long, 3-nerved; floral glumes lanceolate, scabrous-strigulose, strongly 5-nerved, 5 mm. long.

This species is related to *P. occidentalis* (Vasey) Rydb. (*P. flexuosa occidentalis* Vasey), but differs in the short ligules and the short broad leaves.

WYOMING: Spread Creek, at an altitude of 2900 m., July, 1897, *F. Tweedy 13* (type, in herb. N. Y. Bot. Gard.).

Poa subreflexa sp. nov.

Perennial, with a horizontal rootstock; stem ascending, 5–6 dm. tall; lower sheath finely and retrorsely strigulose; ligules very short and truncate; leaf-blades flat, flaccid, 7–10 cm. long, 3–4 mm. wide, spreading; panicle open, about 1 dm. long; branches reflexed, the lower in 3's or 4's, 1–3 cm. long; spikelets pale green, 6–7 mm. long, 3- or 4-flowered; empty glumes glabrous, with broad scarious margins, lanceolate, the first 1-nerved, about 3 mm. long, the second 3-nerved and about 4 mm. long; flowering glumes lanceolate, 5 mm. long, scabrous-strigulose, strongly 5-nerved.

This species is related to *P. Wheeleri* and *P. Olneyae*, but differs from both in the reflexed branches of the panicle and the broad flaccid leaves.

COLORADO: In shade of spruces on the bank of a creek, mountains north of Steamboat Springs, July 26, 1891, State Agricultural College distribution *no. 3731* (type, in herb. N. Y. Bot. Gard.).

Poa subtrivialis sp. nov.

Perennial, with a rootstock; stem slender, 4–6 dm. high, smooth; ligules very short and truncate; sheaths narrow, striate, exceeding the nodes; leaf-blades erect, flaccid, 8–15 cm. long, about 2 mm. wide, flat, dark green; panicle narrow, 1–2 dm. long; branches erect, scabrous, spikelet-bearing above the middle; spikelets light green, 3–4 mm. long, 2–3-flowered; first empty glume very narrow, 2 mm. long, smooth; the second lanceolate, 2.5 mm. long, prominently 3-nerved; floral glumes 2.5 mm. long, glabrous, obscurely nerved; cobweb very scant.

This is closely related to the European *P. nemoralis*, but differs in the truncate ligules, the smaller spikelets, and more strongly nerved empty glumes. It has the narrow inflorescence and narrow empty glumes of *P. nemoralis* and thereby differs from *P. interior*, which also has been confused with the European relative.

WYOMING: Big Horn Mountains, July, 1899, *F. Tweedy 2141*, (type, in herb. N. Y. Bot. Gard.); Gros Ventre River, Aug., 1897, *F. Tweedy 101*.

IDAHO: Northern Idaho, 1892, *J. H. Sandberg 373*.

Distichlis dentata sp. nov.

Perennial, with a creeping branched scaly rootstock; stem 1–3 dm. high, very leafy; leaf-blades 5–12 cm. long, 2–3.5 mm. wide, flat or slightly involute; panicle of the pistillate plant 4–8 cm. long, 2–2.5 cm. wide; spikelets 1–2 cm. long, 5–8 mm. wide, 7–17-flowered; empty glumes lanceolate, about 5 mm. long, short-acuminate, scarious-margined; floral glume ovate in lateral view, 6 mm. long, fully 2 mm. wide from keel to margin, short-acuminate; palet nearly as long, dentate on the keels; panicle of the staminate plant looser, 5–10 cm. long; spikelets more compressed, floral glumes lanceolate in lateral view, straw-colored, acute, thin.

This species differs from *D. spicata* and *D. stricta* in the broader leaves, larger and broader spikelets, larger and broader floral glumes and palets in the pistillate plant, and the distinct dentation on the keels of the latter. It has the broad leaves and the habit of *D. thalassica*, but lacks the loose sheaths of that species. The latter lacks the dentation of the palet characteristic of *D. dentata*.

WASHINGTON: 1893, *Sandberg & Leiberg 463* (♀, type, in herb. Columbia Univ.); Okanagon Valley, 1897, *Elmer 508* (♀.)

OREGON: Wild Horse Meadow, Southeastern Oregon, 1901, *Griffiths & Morris 504* (♂).

SASKATCHEWAN: Carlton House, *Richardson 28* (Franklin's Second Journ.).

NEVADA: Pleasant Valley, 1865, *Stretch 203* (♂); Carson, *248* (♀).

Festuca saximontana sp. nov.

? Festuca ovina pseudovina Beal, Grasses N. Am. **2**: 595. 1896.

Festuca pseudovina Rydb. Mem. N. Y. Bot. Gard. **1**: 56. 1900.

Not *F. pseudovina* Hack. 1880.

Festuca ovina pseudovina Piper, Contr. U. S. Nat. Herb. **10**: 26, 27. 1906. Not *F. ovina pseudovina* Hack. 1881.

Densely cespitose, perennial, with intravaginal innovations; stem 2–4 dm. high, slender, glabrous; basal leaf-sheaths short, closed only at the base, loose above; ligules very short and rounded; leaf-blades very slender, 3–10 cm. long, less than half a millimeter wide, strongly involute, in age becoming strongly striate; panicle very narrow and spike-like, 4–10 cm. long; its branches erect or nearly so, short; spikelets 4–6-flowered; first empty glume 1-nerved, about 2 mm. long, the second 3-nerved, 2.5 mm. long; floral glumes lanceolate, 3–5 mm. long, glabrous; awn 1–2 mm. long.

This species is rather common on dry hillsides and mountains from Saskatchewan to Colorado and British Columbia up to an altitude of 3600 m.

It has been mistaken for the European *F. pseudovina* Hackel. The latter was based on *F. ovina* Host, Gram. Aust. **2**: *pl. 84*. This plate does not at all represent our North American plant. The figure represents a small plant with a short open panicle, while our plant has a very narrow, rather long panicle with erect branches. Piper in his monograph (Contr. U. S. Nat. Herb. **10**: 27. 1905) cites Host's plate *no. 86*, instead of *no. 84*. Whether this is a mere misprint or whether Piper really had the former plate in mind, I do not know. Plate 86, representing *F. stricta*, illustrates a plant in habit much more like our plant. Whether Beal (Grasses N. Am. **2**: 595) had in mind the same plant as Piper and myself is very doubtful, as he cites only specimens from Michigan, and I have seen no specimens of *F. saximontana* from that state. As the type the following may be assigned:

ALBERTA: Vicinity of Banff, 1899, *W. C. MacCalla 2331* (type, in herb. N. Y. Bot. Gard.).

Festuca calligera (Piper) sp. nov.

Festuca amethystina asperrima Hack.; Beal, Grasses N. Am. **2**: 601. 1896. Not *F. asperrima* Link, 1822.

Festuca ovina calligera Piper, Contr. U. S. Nat. Herb. **10**: 27. 1906.

This I think is specifically distinct from *F. ovina*. In the herbaria at the New York Botanical Garden are found the following specimens:

ARIZONA: Southern slope of San Francisco Mountains, 1904, *Cannon & Lloyd;* Flagstaff, 1883, *Rusby 901* (dupl. of type); near Tucson, 1892, *Toumey.*

UTAH: Fish Lake Plateau, Aug. 9, 1905, *Rydberg & Carlton 7689* and *7680.*

COLORADO: Camp on Grizzly near foot of Rabbit Ear Range, State Agric. College distribution *no. 3649;* Breckenridge, 1896, *Shear 1080.*

Vulpia megalura (Nutt.) comb. nov.

Festuca megalura Nutt. Jour. Acad. Phila. II. **1**: 188. 1848.

The group of annual grasses with usually but one stamen, generally included in *Festuca*, is so unlike the typical species of that genus that it very well deserves generic rank. The genus *Vulpia* Nees should therefore be reëstablished.

Vulpia reflexa (Buckley) comb. nov.

Festuca reflexa Buckley, Proc. Acad. Phila. **1862**: 98. 1863.

Vulpia pacifica (Piper) comb. nov.

Festuca pacifica Piper, Contr. U. S. Nat. Herb. **10**: 12. 1906.

Vulpia octoflora (Walt.) comb. nov.

Festuca octoflora Walt. Fl. Car. 81. 1788.

Bromus Flodmanii sp. nov.

Bromus aleutensis Rydb. Mem. N. Y. Bot. Gard. **2**: 61. 1900. Not *B. aleutensis* Trin. 1853.

A short-lived perennial; stem glabrous, 6–10 dm. high; sheaths retrorsely pilose; ligules 3–4 mm. long, laciniate; leaf-blades 2–3 dm. long, 6–10 mm. wide, minutely scabrous; panicle 1–2 dm. long; branches erect or nearly so; spikelets 2.5–3.5 cm. long, 5–7 mm. wide; empty glumes lanceolate in lateral view, about 1 cm. long, glabrous, acute, the first 3-nerved, the second 5-nerved; floral glumes about 15 mm. long, scabrous, narrowly margined, acuminate, slightly bifid; awn 4–6 mm. long; palet nearly as long as the floral glumes.

The first two specimens cited below were included in *B. marginatus latior* by Shear. He, however, has made on the sheet the following note: "very near *aleutensis*," to which species the specimens were originally referred. *B. Flodmanii* differs from *B. marginatus latior* in the scabrous, not pilose floral glumes, and the narrow inflorescence; from *B. aleutensis* it differs in the shorter awns, the smaller florets, and the less open inflorescence, and from *B. Hookerianus* in the smaller spikelets, shorter awns, and narrower scarious margins of the floral glumes. It agrees very well with the description and figure of *Ceratochloa breviaristata* Hook., but the palet is nearly as long as the floral glume.

MONTANA: Sheep Creek, Aug. 8, 1896, *J. H. Flodman 187* (type, in herb. N. Y. Bot. Gard.); same locality and date, *Rydberg 3308*.

UTAH: Mount Nebo, 1905, *Rydberg & Carlton 7595*.

WYOMING: Buffalo Fork, 1897, *F. Tweedy 65*.

Agropyron latiglume (Scribn. & Smith) sp. nov.

Agropyron violaceum latiglume Scribn. & Smith, U. S. Div. Agrost. Bull. **4**: 30. 1897.

Agropyron inerme (Scribn. & Smith) sp. nov.

Agropyron divergens inermis[*e*] Scribn. & Smith, U. S. Div. Agrost. Bull. **4**: 27. 1897.

Hordeum depressum (Scribn. &. Smith) sp. nov.

Hordeum nodosum depressum Scribn. & Smith, U. S. Div. Agrost. Bull. **4**: 24. 1897.

Elymus jejunus (Ramaley) sp. nov.

Elymus virginicus jejunus Ramaley, Minn. Bot. Stud. **1**: 114. 1894.

Elymus virginicus minor Vasey; Rydb. Contr. U. S. Nat. Herb. **3**: 193. 1895.

This was well described by Professor Ramaley. The description was overlooked when I a year later took up Dr. Vasey's manuscript name.

Elymus marginalis sp. nov.

Perennial, with a rootstock, somewhat tufted; stem 6–10 dm. high, glabrous or pubescent at the nodes; sheaths close, at least the lower ones retrorsely pilose; leaf-blades spreading, 1–2 dm.

long, 7–10 mm. wide, flat, scabrous beneath, usually pilose above; ligules almost obsolete; spike 1.5–2 dm. long; spikelets usually in pairs, 4–5-flowered; empty glumes 10–12 mm. long, narrowly lanceolate, scabrous on the 4 or 5 nerves, with white or pink scarious margins; floral glumes 10–12 mm. long, glabrous and shining; awns 8–20 mm. long.

This is closely related to *E. glaucus*, but differs in the glabrous floral glumes and the hairy sheaths and the hairy upper surface of the leaf-blades.

BRITISH COLUMBIA: Lower Arrow Lake, June 18, 1890, *Macoun 44* (type in herb. Columbia University).

WASHINGTON: Clallam, 1900, *Elmer 1905*.

Elymus Petersonii sp. nov.

Perennial, with a rootstock; stem 6–8 dm. high, slender, glabrous; sheaths glabrous, striate, shorter than the internodes; ligules very short and truncate; leaf-blades flaccid, 1–1.5 dm. long, 4–5 mm. wide, light green, minutely scabrous on the veins of both sides, or sparingly pilose above; spike very slender and lax; spikelets in pairs or single; empty glumes narrowly lanceolate, acuminate or awn-pointed, about 8 mm. long, 3-nerved, purple-tinged; floral glumes about 1 cm. long, glabrous; awn about 1 cm. long.

This species is also related to *E. glaucus*, but differs in the lax, interrupted spike, glabrous glumes, and the flaccid and more or less hairy leaf-blades.

BRITISH COLUMBIA: Roger's Pass, Selkirk Mountains, Aug. 9, 1904, *H. Peterson* [Shaw's distribution no.] *446* (type, in herb. N. Y. Bot. Gard.).

Elymus vulpinus sp. nov.

Perennial, with a short rootstock; stems 5–7 dm. high, striate, erect; sheaths close, striate, glabrous, often shorter than the internodes; ligule 1 mm. long or less, truncate, brown; spike exserted, 1–1.5 dm. long, 6–7 mm. thick, sometimes slightly nodding; spikelets 1 or 2 at each node, 4–6-flowered; empty glumes linear-lanceolate, 8–10 mm. long, 5-nerved, scabrous on the back; awn scabrous, of about the same length; floral glumes linear-lanceolate, long-acuminate, about 8 mm. long, hispidulous; awn 8–10 mm. long, scabrous.

This is one of the species connecting the genera *Elymus* and *Agropyron*. The type was originally named *Agropyron cani-*

num unilaterale (Cassidy) Vasey, which is the same as *A. Richardsonii.* J. G. Smith in his revision referred it to *A. Gmelini.* It resembles both a great deal in habit, but is distinguished by the hispidulous floral glumes and by the empty glumes, which are attached more or less obliquely, a character which would place the species in *Elymus* rather than in *Agropyron.* It is a close relative of *E. Saundersii* and *E. Macounii*, which also could be referred almost equally well to either genus. In habit *E. vulpinus* is intermediate between the two, but is distinguished by the hispidulous, instead of glabrous, floral glumes and broader empty glumes.

NEBRASKA: Lake region of Grant Co., northeast of Whitman, *Rydberg 1617* (type, in herb. N. Y. Bot. Gard.).

ALBERTA: Devil's Head Lake, Aug. 8, 1891, *Macoun 11452* in part, mixed with *Agropyron subvillosum* and named *A. dasystachyum.*

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GARDEN—No. 129

STUDIES ON THE ROCKY MOUNTAIN FLORA—XX

By PER AXEL RYDBERG

NEW YORK
1909

Reprinted, without change of paging, from BULLETIN OF THE TORREY BOTANICAL CLUB 36:
675–698. 28 D 1909

[From the BULLETIN OF THE TORREY BOTANICAL CLUB 36 675-698. 1909]

Studies on the Rocky Mountain flora — XX

PER AXEL RYDBERG

Phacelia nervosa sp. nov.

Phacelia alpina Rydb. Fl. Colo. 283, in part, as to the Colorado specimens. 1906.

Perennial, with a short rootstock; stems decumbent at the base, 1–3 dm. high, more or less hirsute and with short grayish hairs intermixed; lower leaves with petioles 2–7 cm. long, simple or with a pair of smaller lobes on the petioles; blades lanceolate, 2–5 cm. long, acute, hirsute on both sides, veins rather strong beneath; upper leaves subsessile; inflorescence soon open; the racemes peduncled, in fruit 4–9 cm. long; calyx more or less tinged with purple, about as long as the corolla; sepals narrowly linear, acute, hirsute, with a strong midrib; corolla white or nearly so, pubescent, about 5 mm. long; filaments about twice as long as the corolla, slightly bearded at the base with short hairs; seeds lance-ovoid, 2.5 mm. long, brown, faveolate.

This was mistaken for *Phacelia alpina*, which it resembles in habit, but it differs in the longer and more open racemes, the longer calyx-lobes, which about equal the corolla and have a strong midrib, in the almost glabrous filaments, in the whitish instead of lilac corolla, and in the more acute seeds. It grows on high mountains at an altitude of 3000 m. or more.

COLORADO: Silver Plume, Aug. 24, 1895, *P. A. Rydberg* (type, in herb. N. Y. Bot. Gard.); same locality and date, *C. L. Shear 3253;* Mt. Harvard, Aug. 17, 1896, *C. L. Shear 3790;* 1896, *F. E. Clements 408;* near Ironton, San Juan County, July, 1899, *C. C. Curtis.*

Phacelia Burkei sp. nov.

Perennial, with a taproot; stems 2–3 dm. high, canescent; basal leaves 3–10 cm. long, petioled; blades lanceolate, entire, strongly veined, densely white-canescent on both sides; inflorescence branched, open; racemes elongated, 2–8 cm. long; calyx canescent and hispid-ciliate; lobes narrowly linear, obtuse, two thirds as long as the corolla, with a rather strong midvein; corolla pubescent, white, 4–5 mm. long; stamens about twice as long as the corolla, villous-bearded; seeds 4, dark chestnut-brown, 2 mm. long, puberulent, ellipsoid, strongly but finely faveolate.

This resembles *P. leucophylla* Torrey in general habit, but differs in the narrow and more strongly ribbed calyx-lobes, the smaller and white corolla, and the more finely faveolate seeds.

IDAHO: Snake Country, *Burke* (type, in herb. Columbia Univ.).

WASHINGTON: Collector not given.

Phacelia leptosepala sp. nov.

Perennial, with a taproot and a more or less cespitose rootstock; stems ascending, hirsute, 1–3 dm. high; leaves usually simple, hirsute on both sides, 5–10 cm. long, oblanceolate or elliptic; the lower ones petioled; inflorescence with several short branches; calyx hirsute; lobes narrowly linear, hirsute, nearly as long as the corolla, acute; corolla white, glabrous or nearly so, 5 mm. long; filaments about twice as long, sparingly villous-bearded.

This species is probably most nearly related to *Phacelia nemoralis* Greene, but differs in the low, slender, ascending stems, the cespitose habit, the longer and narrower, acute sepals, and the less bearded stamens. It somewhat resembles *P. alpina* in habit, but differs in the narrow calyx-lobes almost equaling the white corolla and in the hirsute pubescence, which consists only of coarse hairs.

BRITISH COLUMBIA: Vermilion Lake, Aug. 5, 1905, *Edith M. Farr 1013* (type, in herb. N. Y. Bot. Gard.); Avalanche débris above Lardo, Selkirk Mountains, June 16, 1905, *Shaw 695*.

MONTANA: Mount MacDougal, 1901, *Umbach 139;* Sperry Glacier, 1903, *Umbach 826*.

Lappula leucotricha sp. nov.

Annual; stem 2–4 dm. high, slender, branched above, densely pilose, especially below, with long white hairs; basal leaves oblanceolate, 2–4 cm. long, softly pilose on both sides; stem-leaves linear or oblong, numerous; bracts linear-lanceolate; sepals linear, 2.5–3 mm. long, in fruit 4–5 mm.; corolla white, 3–3.5 mm. long, 3 mm. broad; fruit erect, about 5 mm. wide; nutlets about 2.5 mm. long, light, almost straw-colored; marginal prickles in one row, not united into a disk, but broadened below and flat, scarcely grooved; back strongly muricate.

This species is related to *Lappula occidentalis* (S. Wats.) Greene, but differs in the soft white spreading pubescence, the white flowers, the smaller fruit with broader, flattened prickles. In *L. occidentalis* the prickles are only slightly broadened below, not flattened, and strongly grooved on the inside.

ARIZONA: Tucson, Apr. 20, 1894, *Toumey* (type, in herb. N. Y. Bot. Gard.); vicinity of Flagstaff, June 16, 1898, *MacDougal 122;* Clifton, Apr., 1881, *Rusby 281.*

UTAH: St. George, 1877, *Palmer 359.*

Eremocarya muricata sp. nov.

Annual; stem slender, branched throughout with ascending branches, strigose; leaves linear, 2–5 mm. long, hispidulous, the hairs with pustulate bases; racemes short and dense, usually less than 1 cm. long; bracts oblong, 1–2 mm. long; sepals linear, obtuse, 1.5 mm. long, hispidulous on the margins and midvein; corolla white, 1 mm. long; limb scarcely 0.5 mm. wide; nutlets lanceolate in outline, long-acuminate, dull, finely muricate.

This species is somewhat intermediate between *Eremocarya micrantha* and *E. lepida.* It resembles the former most in habit, but differs in the more ascending branches, the shorter leaves, and especially in the narrower, muriculate and dull, instead of smooth and shining, nutlets. The latter resemble much those of *E. lepida*, but are narrower and more tapering upwards. *E. lepida* has much broader leaves and larger flowers.

UTAH: Southern Utah, 1874, *Parry 164* (type, in herb. Columbia Univ.).

ARIZONA: Near Camp Lowell, Apr. 13, 1881, *Pringle;* Prescott, 1883, *Rusby 745;* Tuçson Mountains, Apr. 12, 1903, *Thornber;* Plains of Tucson, Apr., 1881, *Lemmon 203;* Mesa, near Tucson, May 14, 1883, *Pringle;* Apr. 25, 1906, *Shear 4235;* Tucson, Apr. 3, 1894, *Toumey.*

Greeneocharis circumscissa (H. & A.) Rydb. comb. nov.

Lithospermum (?) *circumscissum* H. & A. Bot. Beech. 370. 1840.

Piptocalyx circumscissus Torr.; S. Wats. Bot. King's Exp. 240. 1871.

Eritrichium circumscissum A. Gray, Proc. Am. Acad. **10**: 58. 1874.

Krynitzkia circumscissa A. Gray, Proc. Am. Acad. **20**: 275. 1885.

Wheelerella circumscisssa Grant, Bull. So. Calif. Acad. Sci. **5**: 28. 1906.

Piptocalyx Torr. of 1871 is antedated by *Piptocalyx* Oliver of 1870 and therefore *Greeneocharis* Gürke & Harms was proposed instead of the former in the appendix to the Register of the Engler & Prantl, Natürlichen Pflanzenfamilien.* This name was properly published, although no binomials were used. There was therefore no need of substituting another generic name *Wheelerella* as was done by Grant. The fact that the etymology is not as good as it might be does not at all invalidate *Greeneocharis*. Reluctantly the writer is forced to add another binomial to the already too many names of this plant.

Oreocarya spicata sp. nov.

Perennial, with a taproot; stem solitary and simple, virgate, hispid throughout; basal leaves numerous, spatulate, 2–5 cm. long, hispid on both sides; the hairs usually with pustulate bases; stem-leaves linear-oblanceolate or linear, 4–9 cm. long, those of the inflorescence many times longer than the short flower clusters; inflorescence elongated, spike-like; calyx hispid, 4–5 mm. long, lobes oblong-lanceolate, obtuse; corolla 6 mm. long, 4 mm. broad; nutlets 4 mm. long, ovate in outline, scarcely keeled on the back, white and shining, smooth on the back, margins merely acute.

This species is closely related to *Oreocarya virgata*, from which it differs in the light-colored, smooth nutlets, the smaller corolla-limbs, shorter and broader basal leaves. The nutlets in *O. virgata* are more acuminate, brown or brownish gray, with a more distinct ridge on the back, more or less transversely rugose and tubercled on the back, and with sharper margins.

COLORADO: Artist's Glen, Aug. 1, 1901, *Clements 102* (type, in herb. N. Y. Bot. Gard.); North Cheyenne Cañon, July 14, 1896, *Ernst A. Bessey*; "Colorado," *G. W. Hulse*.

Cryptanthe leptophylla sp. nov.

Annual; stem simple, slender, erect, strigose throughout, 1.5–3 dm. high; leaves narrowly linear, 1–3 cm. long, 0.5–1.5 mm. broad, strigose; inflorescence cymose, short, at the end of the stem, and on a few small branches; calyx-lobes linear-filiform,

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*Gesamtregister 462. 1899.

3–4 mm. long, in fruit 8–10 mm. long, white-silky with long spreading hairs; corolla minute, shorter than the calyx; limb hardly 0.5 mm. wide; nutlets 3 mm. long, narrowly lanceolate, long-acuminate, strongly muricate; groove closed, 2-forked at the base.

The type sheet of this species was determined by Dr. Watson as *Eritrichium barbigerum*. It is abundantly distinct from *Cryptanthe barbigera*, however, the main distinctions being the narrow strigose leaves, the strigose instead of hirsute or hispid stem, the minute corollas, and the narrower and differently shaped nutlets.

UTAH: St. George, 1877, *E. Palmer 350* (type, in herb. Columbia Univ.).

Cryptanthe confusa sp. nov.

Cryptanthe affinis Rydb. Mem. N. Y. Bot. Gard. **1**: 330, in part. 1900.

Annual; stem rather stout, hispid, branched; leaves oblong or oblong-oblanceolate, 2–5 cm. long, 3–8 mm. wide, coarsely hirsute; spikes at first very short, subcapitate, in age 4–5 cm. long; calyx-lobes 2 mm. long, lance-subulate, hispid, in fruit 3–4 mm. long; corolla about 3 mm. long; limb scarcely 1 mm. wide; nutlets ovate, 2 mm. long, light-colored, smooth, shining, thin-walled, attached by the lower half or two thirds; groove closed and simple to the base.

This species is related to *Cryptanthe affinis* and *C. leiocarpa*, but differs from both in the broader leaves. The nutlets are most like those of the former but the attachment extends somewhat higher.

WYOMING: Upper Madison Cañon, Yellowstone Park, Aug. 3, 1897, *Rydberg & Bessey 4884* (type, in herb. N. Y. Bot. Gard.).

IDAHO: Beaver Cañon, June 27, 1895, *Rydberg*; Latah County, July 6, 1894, *Piper 1940*.

UTAH: Central Utah, 1875, *Parry 67* (?).

Cryptanthe grandiflora sp. nov.

Annual; stem branched, 2–4 dm. high, hirsute with white hairs; leaves broadly linear, lanceolate, or oblong, 3–5 cm. long, 5–10 mm. wide, hirsute, the hairs with pustulate bases; spikes lax, in fruit often 1 dm. long; calyx-lobes 3 mm. long, in fruit 5 mm., very hispid; corolla white, 4–5 mm. long; limb 5–6 mm. wide; nutlets ovate, 2.5 mm. long, shining, smooth, rather thin-walled; groove narrow, 2-forked at the base.

This species has been variously named *Cryptanthe leiocarpa*, *C. ambigua*, and *C. Torreyana*. It differs from the first in the 2-forked groove, from the second in the smooth nutlets, and from all in the large corolla. It is most related to *C. Torreyana*, having somewhat similar nutlets, but is easily distinguished from it by the large flowers and broad leaves. It may be the same as the large-flowered form of *C. Torreyana calycosa* referred to by Piper;* but it does not have the elongated calyx-lobes of that species and has three to four times as broad corolla.

IDAHO: Valley of Clearwater River, April 23, 1892, *Sandberg, MacDougal & Heller 10* (type, in herb. N. Y. Bot. Gard.); about Lewiston, April 30, 1896, *A. A. & E. Gertrude Heller 2998.*

WASHINGTON: Wawawai, May, 1897, *Elmer 775;* near Montesano, June 10, 1898, *A. A. & E. Gertrude Heller 3924.*

Mertensia pallida sp. nov.

Perennial, with a thick rootstock; stem glabrous, very pale, 5–8 dm. high, leafy; lower leaves oblanceolate, the upper narrowly lanceolate, 5–8 cm. long, glabrous or minutely muriculate, ciliolate on the margins, pale; inflorescence narrowly paniculate; pedicels usually strigulose or sometimes the hairs represented only by the somewhat pustulate bases; calyx-lobes oblong, about 1 mm. long, obtuse, ciliate on the margin; corolla about 1 cm. long, the tube about equaling the limb; filaments about 1 mm. long, dilated and at the apex broader than the anthers, which are about 2 mm. long.

This is related to *Mertensia ciliata* but differs in the paler narrower leaves, the smaller corolla, and the usually strigulose pedicels.

MONTANA: Lima, June 28, 1895, *Rydberg 2777* (type, in herb. N. Y. Bot. Gard.); June 30, 1895, *Shear 3395;* Spanish Basin, July 11, 1896, *Flodman 751.*

Mertensia Leonardi sp. nov.

Perennial, with thick rootstock; stem erect, glabrous, pale, 5–10 dm. high, leafy; leaves thin, glabrous and smooth beneath, more or less pustulate-muricate above, and ciliolate on the margins; the lower short-petioled; blades oblanceolate, 4–7 cm. long; the upper sessile, lanceolate or ovate, 5–15 cm. long; inflorescence much branched; pedicels sparingly pustulate; calyx-lobes lanceolate, 4 mm. long, twice as long as the calyx-tube, ciliolate on the margins; corolla-tube 6–7 mm. long; limb 8–10 mm. long, 7–8 mm. wide.

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* Contr. U. S. Nat. Herb. 11: 484. 1906.

This is related to *Mertensia arizonica*, *M. intermedia*, and *M. stenoloba*. From the former it differs in the long calyx-lobes and the short calyx-tube and from the latter two in the long and ample limb of the corolla. It is a larger plant than any of the three and often reaches a height of 1 m.

UTAH: Mill Creek Cañon, July 31, 1884, *F. E. Leonard* (type, in herb. N. Y. Bot. Gard.).

Mertensia humilis sp. nov.

Perennial, with a woody tap-root and cespitose caudex; stem 1–2 dm. high, ascending or decumbent, glabrous; basal leaves petioled, 3–8 cm. long; blades thick, elliptic to ovate, glabrous beneath, pustulate-muricate above, ciliolate on the margins, stem-leaves sessile, elliptic or ovate, rarely oblong, 2–4 cm. long; pedicels with scattered large pustules; calyx-lobes lanceolate, 2–3 mm. long, hispid-ciliolate on the margins; corolla 7–8 mm. long; tube slightly shorter than the limb; stamens inserted in the tube of the corolla; filaments short and narrow.

The specimens referred to this species were all named *Mertensia alpina* by the collectors. A few years ago the present writer regarded them as representing the typical *M. alpina* and redescribed the true *M. alpina* (Torr.) Don under the name *M. obtusiloba*. A reëxamination of James's plant (type of *M. alpina*) has convinced me of the identity of *M. alpina* and *M. obtusiloba*. *M. humilis* combines the corolla and stamens of *M. alpina* with the leaf-surface, pedicels, and calyx of *M. lanceolata*. In habit it is intermediate between the two.

WYOMING: Sand Creek, Albany Co., June 2, 1900, *A. Nelson 7043*; (type, in herb. N. Y. Bot. Gard.); Laramie Hills, May 16, 1894, *A. Nelson 33*; May 14, 1900, *E. Nelson 184*.

Scutellaria veronicifolia sp. nov.

Perennial, with creeping rootstock; stem 2–4 dm. high, finely puberulent, more or less purplish; leaves below the inflorescence ovate, obtuse, coarsely crenate, 1–4 cm. long, minutely puberulent or glabrate, short-petioled; those of the inflorescence and branches oblong and entire or nearly so; pedicels 3–5 mm. long; calyx finely pubescent, 6 mm. long; corolla 25–30 cm. long, its tube rather abruptly widening, 7–8 mm. broad at the throat.

This species is related to *Scutellaria angustifolia* and *S. antirrhinoides*, but differs from both in the broader corolla-tube. From the former it differs also in the broader and usually toothed stem-leaves and from the latter in the large flowers.

IDAHO: *Sandberg, MacDougal, & Heller 115* (type, in herb. N. Y. Bot. Gard.).

CALIFORNIA: Mokelumne Hill, 1853–4, *Bigelow* (Whipple Exp.); 1846, *Fremont LIII.*

Stachys asperrima sp. nov.

Perennial, with a rootstock; stem stout, 4–6 dm. high, coarsely hispid on the angles with spreading or reflexed hairs; leaves nearly sessile, oblong, elliptic, or oblong-lanceolate, 5–8 cm. long, truncate or rounded at the base, coarsely crenate, hispid above, hispid on the veins and also puberulent beneath; spike 1–2 dm. long; calyx densely hispid and somewhat glandular; lobes lance-subulate, spinulose-tipped; corolla purplish, 10–12 mm. long, puberulent, and more or less hirsute on the lips outside.

This species belongs to the *Stachys palustris* group, but little resembles that species in general habit. In leaf-form, pubescence, and general habit, it reminds one of *S. arenicola* Britton, but the leaves are crenate instead of serrate and the pubescence is coarser. It resembles also *S. rivularis* Heller, but the pubescence is coarser and the calyx-lobes are lance-subulate instead of lanceolate.

UTAH: Towards Jordan City, July 7, 1884, *F. E. Leonard 138* (type, in herb. N. Y. Bot. Gard.).

Stachys Leibergii sp. nov.

Perennial, with a horizontal rootstock; stem 3–6 dm. high, sharply angled, glabrous below, softly hirsute above; leaves sessile, lanceolate, acute, 4–8 cm. long, crenate-dentate, pubescent on both sides with short appressed hairs or in age glabrate; bracts lanceolate, mostly entire, often purplish-tinged; calyx softly pubescent, often purplish; tube obpyramidal, about 4 mm. long; lobes lanceolate, gradually setose-acuminate, almost as long as the tube; corolla about 12 mm. long, rose-colored, glabrous.

This species is related to *Stachys palustris* and *S. scopulorum.*

From the former it differs in the more gradually acuminate and almost erect calyx-teeth, and from the latter in the short appressed pubescence of the leaves, and the usually glabrous lower part of the stem.

IDAHO: Low meadow, Blue Creek, alt. 700 m., Coeur d'Alene Mountains, July 20, 1895, *John B. Leiberg 1328* (type, in U. S. Nat. Herb. *no. 250,811*); Valley of Coeur d'Alene River, Kootenai Co., July 13, 1892, *Sandberg, MacDougal, & Heller 639*, in part.

Stachys ampla sp. nov.

Perennial, with a rootstock; stem 5–7 dm. high, softly hirsute and more or less viscid, especially above; leaves ovate to lanceolate, 5–10 cm. long, sessile or nearly so, rounded or subcordate at the base, acute at the apex crenate-serrate, softly pubescent on both sides and more or less glandular-granuliferous; spike interrupted, very leafy; calyx soft-pubescent and glandular, about 9 mm. long; lobes lance-subulate, spinulose-tipped; corolla rose-colored or pink, about 15 mm. long, somewhat puberulent without; lower lip very broad; lateral lobes half as broad and three fourths as long as the middle one.

This species is related to *S. scopulorum* and *S. teucriformis* but differs from both in the larger corolla, the broader lower lip, and the unusually large lateral lobes of the lip.

SOUTH DAKOTA: Custer, Black Hills, Aug. 20, 1892, *Rydberg 1208* (type, in herb. N. Y. Bot. Gard.).

Audibertiella argentea sp. nov.

A low shrub; branches cinereous-puberulent; leaves petioled, 1–2 cm. long; blades rounded, obovate-spatulate, rounded or retuse at the apex, scurfy-cinereous, at first silvery white; bracts broadly obovate, about 1 cm. long, membranous, strongly veined, puberulent and ciliate; corolla blue, about 1 cm. long; lower lip only slightly longer than the upper one, its lobes short and rounded; longer filaments about 12 mm. long, anther-bearing connective 2.5–3 mm. long, sterile connective lacking.

Dr. E. L. Greene* separated *Audibertia polystachya* Benth. from the rest of the genus, as understood by Bentham and Gray, and proposed the name *Ramona* for this species. The other species he reduced to *Salvia*. Briquet, ignorant of Greene's work, discovered (as Greene had done) that *Audibertia* could not hold for this genus, as the name had been applied two years earlier to a section of *Mentha*, proposed the name *Audibertiella*,* and renamed all the known species under this genus. Later he discovered that Greene had proposed the name *Ramona* for one of the species. He, however, did not agree with Greene that the genus, with that species excepted, should be merged in *Salvia*. He therefore restored the genus as understood by Bentham and Gray, adopted Greene's name, and renamed the species under *Ramona*. The writer agrees with Greene in keeping *Ramona* as a distinct genus for *Audibertia polystachya*, but agrees with Briquet that none of the species should be merged into *Salvia*. It is therefore necessary to restore *Audibertiella* Briq. As this name was a substitute for the invalid *Audibertia*, the type species of the latter becomes the type of the former. The type is therefore *Audibertia incana* Benth. The type of *Ramona* was *Audibertia polystachya*. *Audibertia grandiflora* may represent a third genus.

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* Pittonia **2**: 235.

The present species is a close relative to *A. incana* and has been confused with it. It differs in the broad rounded obovate-spatulate leaves, the smaller flowers and the comparatively shorter lower lip of the corolla. In *A. incana* the leaves are oblong-spatulate, often 3–4 cm. long, the corolla almost 1.5 cm. long, and its lower lip about half longer than the upper one. *A. incana* ranges from Washington to Idaho and Oregon. The range of *A. argentea* is much more southerly.

ARIZONA: Mokia Pass, 1877, *Palmer 395* (type, in herb. Columbia Univ.); 1876, *Palmer 358*.

UTAH: St. George, 1874, *Parry 159*; 1872, *Bishop*.

NEVADA: Monitor Valley, 1868, *S. Watson 829*; Kernan, Meadow Valley Wash, April 29, 1902, *Goodding 655*; Palisade, June 14, 1882, *M. E. Jones 4035*; Miller Mountain, 1883, *Shockley*; Charleston Mountain, 1898, *Purpus 6072*.

CALIFORNIA: Surprise Cañon, Panamint Mountains, *Coville & Funston 601*; Panamint Cañon, May 4, 1897, *M. E. Jones*; Providence Mountains, May, 1902, *Brandegee*; Mojave Desert, May 30, 1901, *Parish 4935*.

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* Bull. Herb. Boiss. 2: 73.

Hedeoma longiflora sp. nov.

Perennial, with a slender taproot; stems branched at the base, decumbent or ascending, finely puberulent; leaves spreading, linear-lanceolate, lanceolate or oblong, 1–2 cm. long, grayish-puberulent, subsessile; calyx 7–8 mm. long, strongly ribbed, puberulent, somewhat saccate below; teeth subulate, the lower 2 mm., the upper 1 mm. long; corolla about 12 mm. long, puberulent, with an ample limb.

This has been confused with *Hedeoma Drummondii*, but differs in the broader leaves, which are divergent, and in the calyx, which is distinctly saccate. *H. Drummondii* differs from the related species in the narrow, ascending or suberect leaves and the narrow calyx, scarcely at all saccate. *H. longiflora* has the long corolla of *H. Drummondii* and is distinguished thereby from *H. sancta*, *H. thymoides*, and *H. ovata*, which have all been included in *H. Drummondii.* It grows on cliffs and in cañons of the Great Plains region.

NEBRASKA: Cliffs of cañons of Banner Co., 1890, *Rydberg X297* (type, in herb. N. Y. Bot. Gard.); Court House Rock, 1891, *Rydberg 297.*

SOUTH DAKOTA: Custer, June 16, 1892, *Rydberg 941;* Rapid Creek, 1891, *T. A. Williams.*

KANSAS: Wet rocks, Stanton Co., Aug. 5, 1895, *Hitchcock 402.*

Madronella sessilifolia sp. nov.

Perennial, with a short caudex; stems stout, about 3 dm. high, finely puberulent, densely so above; leaves sessile or nearly so, ovate or lanceolate, entire, obtuse, rather pale, finely puberulent or in age glabrous; bracts oval, 10–12 mm. long, puberulent on the back, ciliate on the margins; calyx 8–9 mm. long, pilose, striate; lobes lanceolate, about 1 mm. long; corolla 12–13 mm. long, pubescent.

The type was determined as *Monardella odoratissima*, but it differs from that species in the pale foliage, the shorter and finer pubescence, the broader leaves, and the less distinctly ciliate calyx-lobes.

UTAH: St. George, 1877, *Palmer 393* (type, in herb. N. Y. Bot. Gard.).

Madronella oblongifolia sp. nov.

Perennial, suffruticose at the base; stems 1–3 dm. high, grayish puberulent or in age glabrate; leaf-blades oblong, 1–3 cm. long, minutely puberulent, or in age glabrate, entire, obtuse, usually with distinct, but short, slender petioles; bracts pale or tinged with rose, finely puberulent, ciliate on the margins, oval, 9–12 mm. long; calyx about 1 cm. long, pilose; its teeth lanceolate, and strongly ciliate; corolla white to rose-colored, 12–14 mm. long, puberulent.

This has been confused with *M. odoratissima*, but differs in the shorter pubescence, which is sometimes wholly lacking on the older leaves, the merely puberulent instead of pilose bracts, the more distinctly petioled leaves, and more suffruticose habit. It grows on mountain sides at an altitude of 1500–3000 m.

UTAH: Mount Nebo, 1905, *Rydberg & Carlton 7706* (type, in herb. N. Y. Bot. Gard.), *7757* and *7700;* mountains north of Bullion Creek, near Marysvale, *7178;* American Fork, 1885, *Leonard 178;* Logan, Aug. 9, 1895, *Shear 3164;* same locality and date, *Rydberg;* Alta, July 30, 1879, *M. E. Jones 1109;* Central Utah, 1873, *Parry 75.*

Mentha glabrior (Hook.) Rydb. sp. nov.

Mentha canadensis glabrata Benth. Lab. 181. 1833. Not *M. glabrata* Vahl. 1794.

Mentha canadensis glabrior Hook. Fl. Bor.-Am. **2**: 111. 1838.

Mentha canadensis borealis Piper, Contr. U. S. Nat. Herb. **11**: 492, in part. 1906. Not *M. borealis* Michx. 1803.

This differs from *Mentha canadensis* in the almost glabrous leaves and stem, and much shorter pubescence on the calyx. Recently several botanists have included *M. Penardi* (*M. arvensis Penardi* Briq.) in *M. canadensis glabrata* or *M. arvensis glabrata*, but I think they are distinct. In *M. Penardi* the leaves have much shorter petioles, nearly always shorter than the flower-clusters, the stem is more hairy and the calyx-teeth are lanceolate and acute, much longer than broad. *M. glabrior* has the abruptly acuminate calyx-lobes of *M. canadensis* but they are not so short. This species has been taken as *M. borealis* Michx., and even Bentham cited the latter as a synonym, but by reading Michaux's description, one can easily see that it without any doubt refers to the true *M. canadensis*. *M. canadensis* is not found in the Rocky Mountain region, and *M. glabrior* is very rare. The common plant of the Rockies is *M. Penardi* and that of the Pacific slope is *M. lanata*, discussed below.

Mentha lanata (Piper) Rydb. sp. nov.

Mentha arvensis lanata Piper, Bull. Torrey Club **29**: 223. 1902.

Mentha canadensis lanata Piper, Contr. U. S. Nat. Herb. **11**: 492. 1906.

I think that this deserves specific rank, differing not only in the amount but also in the kind of pubescence and in the shape of the calyx lobes. Sometimes the leaves are very densely villous, almost white. Its range extends from British Columbia to Idaho and California. The specimens from Maine accredited to this by Robinson and Fernald * probably represent unusually hairy specimens of *M. canadensis* and not this.

Mentha occidentalis sp. nov.

Perennial, with a rootstock; stem 3–6 dm. high, with short crisp pubescence, at least on the angles above; petioles 5–10 mm. long; leaf-blades ovate or ovate-lanceolate, short-acuminate, strongly serrate, 4–8 cm. long, minutely pubescent on both sides or in age glabrate; bracts linear-lanceolate, 1 cm. long or more, usually exceeding the flowers; calyx about 3 mm. long, pilose, teeth lanceolate, acute or acuminate, longer than broad; corolla white or pink, 5–6 mm. long; its lobes oblong, obtuse.

This has been confused with *Mentha canadensis* and *M. glabrata*, but differs from all the species of this group in the long linear-lanceolate bracts, longer than the flower clusters, and the larger corollas. Otherwise it comes nearest *M. Penardi*.

IDAHO: Forest, Nez Perces County, 1896, *A. A. & E. Gertrude Heller 3486* (type, in herb. Columbia Univ.).

WASHINGTON: 1889, *Vasey 463*; Chehalis River, 1897, *Lamb 1235*.

MONTANA: Jocko River, Aug. 27, 1897, *Elrod and assistants 213*.

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* Gray's New Manual 711. 1908.

Scrophularia serrata sp. nov.

Perennial; stem 1–2 m. high, angled, sparingly puberulent or glabrous, slightly glandular in the inflorescence; leaf-blades ovate or cordate, 5–15 cm. long, regularly serrate with the teeth directed forward, acute or short-acuminate, minutely glandular-puberulent on both sides; bracts rather conspicuous, linear-lanceolate, the lowest 2–3 cm. long; calyx-tube hemispheric, glabrous or nearly so, 2 mm. long; lobes rounded, 2 mm. long; corolla-tube short, 6–7 mm. long, nearly 5 mm. thick; upper lip 4–5 mm. long; sterile stamen obovate-spatulate, purple.

This species is related to *Scrophularia marilandica* and *S. neglecta*. From both it differs in the stout, strongly ascending, instead of more or less spreading branches of the inflorescence; from the former in the larger corolla (about twice as large) and from the latter in the shorter corolla-tube, scarcely twice as long as the calyx, and the finely glandular-puberulent, instead of densely pubescent lower leaf-surfaces. In *S. neglecta* the corolla-tube is about three times as long as the calyx. *S. occidentalis*, the common Rocky Mountain species, has doubly toothed or incised leaves with spreading teeth and a reniform greenish sterile stamen.

IDAHO: Wet places, Granite, N. Idaho, July, 1887, *J. H. Sandberg* (type, in herb. N. Y. Bot. Gard.).

Pentstemon subglaber Rydb. nom. nov.

Pentstemon glaber utahensis S. Wats. Bot. King's Exp. 217. 1871.

Pentstemon utahensis A. Nels. Bull. Torrey Club **26**: 242. 1899. Not *P. utahensis* Eastw. 1893.

PENTSTEMON ALPINUS [A] Torr. Ann. Lyc. N. Y. **1**: 35. 1823

Pentstemon oreophilus Rydb. Bull. Torrey Club **31**: 642. 1905.

A reëxamination of the type of *Pentstemon alpinus* has persuaded me that it is the same as my *P. oreophilus* and not as I thought, the same as *P. riparius* A. Nelson. The latter should therefore be restored.

Pentstemon auricomus A. Nels. sp. nov.

Pentstemon Jamesii A. Nelson, Bull. Torrey Club **25**: 547. 1898. Not *P. Jamesii* Benth. 1846.

I had some correspondence with Professor A. Nelson in 1898, when the latter segregated *Pentstemon similis* from *P. Jamesii*. I think that I then led Professor Nelson astray. At least, I had made a rather serious mistake. Professor Nelson made the following statement in his article in the BULLETIN cited above:

"Before I began work upon these collections Dr. Rydberg had satisfied himself that his Dakota plant closely duplicated the type of *P. Jamesii* which is preserved in the Torrey Herbarium at Columbia University, and with which he has done me the favor of comparing my specimens."

A more thorough investigation of the South Dakota plant shows that the sterile stamens are but slightly bearded and of a different shape and the specimens must be referred to a form of *P. albidus*. The type of *P. Jamesii* consists of two scraps, only the tops of the plant. The bracts, the calyx, and corolla of these scraps resemble closely those of Nelson's plants from Wyoming. The basal leaves of *P. Jamesii* are, however, entirely different from those of Nelson's plant. At the time, there were no good specimens of *P. Jamesii* in the herbaria here in New York, but I have myself collected good specimens near the type locality, which was somewhere on the upper Arkansas River. These show that *P. Jamesii* is much closer to *P. similis* A. Nels., differing in the smaller corolla, the less secund inflorescence, the longer bracts and narrower basal leaves. Typical *P. Jamesii* is represented by *Rydberg & Vreeland 5637*, *5636*, *6610*, *5635* and *5633*; also by *Baker 6* of 1901 and *Osterhout 2084* of 1900.

As the plant described by Professor Nelson at the place cited above is very distinct I adopt the name under which Professor Nelson had distributed the plant, viz., *Pentstemon auricomus*, especially as I, at least indirectly, was the cause of its being suppressed.

PENTSTEMON SUFFRUTESCENS Rydb. Bull. Torrey Club **28**: 503. 30 S 1901

P. caespitosus suffruticosus A. Gray, Syn. Fl. 2^1: 270. 1878.

P. procumbens Greene, Pl. Baker. **3**: 23. 18 N 1901.

Professor A. Nelson, in describing *Pentstemon Xylus*,* expressed his opinion that the latter was the same as *P. caespitosus suffruti-*

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* Bot. Gaz. **34**: 31. 1902.

cosus A. Gray. A careful reading of the original short description of Gray's variety will reveal to anyone that it cannot apply to *P. Xylus*. As *P. suffrutescens* was based exclusively on Gray's variety, it can by no means be called a *nomen nudum* as Professor Nelson is inclined to regard it. To it I refer also *P. procumbens* Greene published nearly two months later.

Pentstemon Thompsoniae (A. Gray) Rydb. sp. nov.

Pentstemon pumilus Thompsoniae A. Gray, Syn. Fl. 2^1: 269. 1878.

This is a very distinct species, not related to *P. pumilus*. Dr. Gray at first * placed *Pentstemon pumilus* with *P. albidus*, *P. Jamesii*, and *P. cristatus*, *i. e.*, in a group to which it rightly belongs, notwithstanding its small size. Afterwards,† he transferred it wrongly to the *P. caespitosus* group, with which it has little in common. *P. Thompsoniae* on the contrary belongs to this group and is a close relative to *P. caespitosus*. I suspect that Dr. Gray has redescribed the true *P. pumilus* Nutt. under the name *P. miser*.‡ I have not seen the type of the latter but the description agrees well with *P. pumilus*.

Pentstemon platyphyllus sp. nov.

Pentstemon heterophyllus latifolius S. Wats. Bot. King's Exp. 222. 1871. Not *P. latifolius* Hoffmgg. 1824.

Dr. Gray in the Synoptical Flora § refers this doubtfully to *Pentstemon azureus Jaffrayanus* Gray (*P. Jaffrayanus* Hook.). The two resemble each other in leaf form and general habit, but there are differences important enough to make them distinct species. I am also inclined to think that *P. Jaffrayanus* is specifically distinct from *P. azureus*, although I have not seen any authentic specimen of the latter. The leaves in *P. Jaffrayanus* are strongly glaucous and the upper are subcordate and clasping at the base; the calyx-lobes are oval or obovate, abruptly short-acuminate or mucronate with an erect tip; the anthers are somewhat hirsutulous at the sinus as well as papillose-hispidulous on the margins; and the sterile stamen is filiform. In *P. platyphyllus* the leaves are less glaucous, never subcordate or clasping at the base; the calyx-lobes are ovate, long-acuminate, with more or less spreading tips; the anthers are merely papillose-hispidulous on the margins but otherwise without pubescence; and the sterile stamen is decidedly broadened upwards. *P. platyphyllus*, as far as the writer knows, is found in Utah only, while *P. Jaffrayanus* grows in California and Oregon. To the former belong the following specimens:

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* Proc. Am. Acad. **6**: 67. 1862.

† Syn. Fl. 2^1: 269. 1878.

‡ Syn. Fl. ed. 2, 2^1: 441. 1886.

§ 2^1: 272. 1878.

UTAH: Cottonwood Cañon, July, 1869, *S. Watson 787;* City Creek Cañon, July 25, 1879, *M. E. Jones 1080;* also July 7, 1880; same locality, July 4, 1883, *Leonard 141*, and Aug. 9, 1884, *208;* mountains near Ogden, July, 1871, *Coulter.*

Pentstemon coccinatus sp. nov.

(?) *Pentstemon Eatonii undosus* Jones, Proc. Calif. Acad. **5**: 715. 1895.

Perennial, with a woody caudex; stem erect, 3–6 dm. high, puberulent; basal leaves petioled; blades ovate or elliptic, acute at both ends, 3–7 cm. long, densely puberulent; lower stem-leaves spatulate to elliptic; the upper ovate or ovate-lanceolate, acuminate; inflorescence lax, more or less secund; calyx about 5 mm. long, puberulent; lobes broadly ovate, abruptly short-acuminate, scarious-margined and denticulate; corolla red, about 2.5 cm. long, nearly tubular, not ventricose, slightly bilabiate, lobes short, rounded; anthers papillose on the margin, glabrous; sterile stamen glabrous, club-shaped, truncate; capsule about 1 cm. long.

This has been confused with *P. Eatonii*, but differs in the puberulent stem and leaves, the more acuminate upper leaves and sepals.

ARIZONA: Grand Cañon of the Colorado, 1898, *MacDougal 173* (type, in herb. N. Y. Bot. Gard.); Oak Creek, June 23, 1883, *Rusby;* Red Cañon Trail, June 10, 1901, *L. F. Ward.*

UTAH: Court House Wash, May, 1892, *Eastwood;* South Utah, 1877, *Palmer 372;* 1874, *Parry 149.*

Synthyris dissecta sp. nov.

Synthyris pinnatifida Rydb. Mem. N. Y. Bot. Gard. **1**: 353. 1900. Not S. Wats. 1871.

Acaulescent perennial, with a short, thick, erect rootstock; leaves 5–10 cm. long, petioled, villous-tomentose; blades oval in outline, twice or thrice pinnatifid into oblong or lanceolate divisions; scape villous-tomentose, 5–20 cm. high; spike dense or in fruit more lax; bracts and calyx densely white-villous; corolla about 6 mm. long, dark-blue or purple, or in age paler; lobes broadly obovate; stamens slightly exserted; ovary villous; fruit obovate, 6 mm. long, villous or in age glabrate.

This species is related to *Synthyris pinnatifida*, and has been mistaken for it, but it differs in the more copious pubescence, especially on the calyx and ovary (in *S. pinnatifida* these are glabrous or merely puberulent on the margins), in the larger dark corolla with obovate instead of oblong lobes, and in the larger fruit. *S. dissecta* grows at an altitude of 2000–3000 m.

MONTANA: Near Bozeman, June 11, 1900, *Chesnut & Jones 199* (type, in herb. N. Y. Bot. Gard.); Bridger Mountains, June 15, 1897, *Rydberg & Bessey 4927*; same locality, 1899, *Flaherty*, and June 26, 1899, *Blankinship*; Old Hollowtop, July 7, 1897, *Rydberg & Bessey 4926*; Beaver Head Co., June, 1888, *Tweedy 70*.

WYOMING: Headwaters, Cliff Creek, Aug. 9–18, 1900, *C. C. Curtis* (good fruit).

Thalesia Sedi (Suksd.) Rydb. comb. nov.

Aphyllon Sedi Suksd. Deuts. Bot. Monats. **18**: 155. 1900.

The three species of the Columbia River region, which have usually been included in *Thalesia uniflora*, differ from the plant of the eastern United States in their longer attenuate calyx-lobes. In all three the lobes are about twice as long as the calyx-tube and narrowly subulate from a broad base; in *T. uniflora* they are scarcely longer than the tube, lanceolate and gradually tapering from the base of the apex. *T. Sedi* differs from the other two Columbian species in the lighter-colored corolla, with narrower, oblong acutish or obtuse lobes, while *T. purpurea* Heller and *T. minuta* (see below) have dark purple corolla and broad, oval or semiorbicular lobes rounded at the apex or sometimes even retuse. It grows on species of *Sedum* and is distributed through parts of Oregon, Washington, and western Montana.

Thalesia minuta (Suksd.) Rydb. comb. nov.

Aphyllon minutum Suksd. Deuts. Bot. Monats. **18**: 155. 1900.

This resembles *Thalesia purpurea* in the color of the flower and the form of the calyx, but the corolla is much smaller, only 15–20 mm. long, more strongly curved, and less funnelform. The corolla of *T. purpurea* is 2–3 cm. long, and more open at the throat. *T. minuta* has been reported parasitic on *Lithophragma*, but may grow on other hosts. It has been collected in Oregon, Washington, Montana, and British Columbia.

Thalesia lutea (Parry) Rydb. comb. nov.

Phelipaea lutea Parry, Am. Nat. **8**: 214. 1874.

Aphyllon fasciculatum luteum A. Gray, Syn. Fl. 2^1: 312. 1878.

This differs from *Thalesia fasciculata* not only in the sulphur-yellow corolla, but also in the acutish corolla-lobes and in the acute rather than acuminate calyx-lobes. It is parasitic on grasses instead of on composites, etc.

MYZORRHIZA Philippi, Linnaea **29**: 36. 1857

Aphyllon § *Nothaphyllon* A. Gray, Bot. Calif. **1**: 584. 1876.

Orobanche § *Myzorrhiza* G. Beck, Bibl. Bot. **4**: 78. 1890.

Following Beck von Mannagetta, many botanists in this country have reduced Gray's section *Nothaphyllon* of *Aphyllon* to *Orobanche*, while they have kept *Thalesia* distinct. Both, as well as a part of *Boschniakia*, were included in *Orobanche* by Beck. The editors of Gray's New Manual evidently took the genus *Orobanche* in the same sense as Beck. In contrasting *Conopholis* and *Orobanche* in the generic key, they give as characters for the former: "Calyx deeply cleft in front"; and for the latter: "Calyx 5-cleft." On the following page, however, they give as characters of *Orobanche minor*: "Calyx cleft before and behind almost or quite to the base," and for *O. ramosa*: "Calyx 4-lobed." *O. minor* is the only typical *Orobanche* found in this country, and this does not agree with the characterization of the genus, as given in the New Manual. Evidently the editors had Gray's genus *Aphyllon* in mind when the key was made.*

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* Another inaccuracy in the treatment of *Orobanche* in the New Manual may be pointed out: *Orobanche purpurea* and *O. ramosa* are there characterized as having "each flower with 3 bracts (1 large and 2 small) at the base of the calyx," *O. minor* and *O. ludoviciana* as having "each flower with 1 or 2 bracts at the base of the calyx," and *O. uniflora* and *O. fasciculata* as being "without bracts." The characters

The typical *Orobanche* has the calyx characteristic of, for instance, *Castilleja* in Scrophulariaceae, *i. e.*, the calyx is deeply cleft in front and behind, with the lateral divisions entire or 2-cleft. None of our native American plants has this structure. They have all (except those included in *Boschniakia* by Gray) an almost equally 5-toothed calyx. There is a group of Old World plants, of which *Orobanche purpurea* and *O. ramosa* are introduced into this country, which have a 4-toothed or only occasionally 5-toothed calyx, but in that case the upper tooth is much smaller. In Gray's New Manual the former is described as having a "5-lobed" calyx. This is only occasionally the case. These species constitute the genus *Kopsia* Dum. or *Phelipaea* Nees (not Desf.). The writer thinks that the five sections of Beck's monograph should be regarded as genera. *Myzorrhiza* Philippi is the only available name for *Aphyllon* § *Nothaphyllon* Gray. This genus differs from *Thalesia* in habit and in the arrangement of the placentae, from *Orobanche* in the regularly 5-toothed instead of 2-cleft calyx, and from both in the presence of bractlets. The type of the genus is

MYZORRHIZA CHILENSIS Philippi, Linnaea **29**: 36. 1857
Orobanche chilensis G. Beck, Bibl. Bot. **4**: 82. 1890.

This is closely related to our most common North American species:

MYZORRHIZA LUDOVICIANA (Nutt.) Rydb.; Small, Fl. SE. U. S. 1093. 1903
Orobanche ludoviciana Nutt. Gen. **2**: 58. 1818.
Phelipaea ludoviciana Walp. Rep. **3**: 461. 1844.
Aphyllon ludovicianum A. Gray, Bot. Calif. **1**: 585. 1876.
? *Aphyllon arenosum* Suksd. Allg. Bot. Zeits. **12**: 27. 1906.

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given for the two first are correct; there are three scales under the flower, one bract and two lateral bractlets; *Orobanche minor* has one bract and no bractlets, while *O. ludoviciana* has 1 or 2 bractlets under the flower. It has exactly the same arrangement as *O. purpurea* and *O. ramosa*, except that one of the bractlets is sometimes lacking and the bract is usually some distance below the calyx. *Orobanche uniflora* and *O. fasciculata* are not without bracts. They are without bractlets, but the bract is found at the base of the longer pedicel. They are like *O. minor* (a typical *Orobanche*) in having no bractlets, but differ in the 5-toothed instead of 2-cleft calyx. *O. ludoviciana* has bractlets and should have been associated with the two first species, if the presence or absence of bractlets was taken as the dividing character. In all the species the bracts are present although situated at different distances from the calyx, depending upon the length of the pedicels.

MYZORRHIZA MULTIFLORA (Nutt.) Rydb. Bull. Torrey Club **33**: 151. 1906

Orobanche multiflora Nutt. Jour. Acad. Nat. Sci. Phila. II. **1**: 179. 1848.

Phelipaea erianthera Engelm.; A. Gray, Proc. Am. Acad. **7**: 372. 1867.

Aphyllon multiflorum A. Gray, Bot. Calif. **1**: 585. 1876.

Myzorrhiza Cooperi (A. Gray) Rydb. comb. nov.

Aphyllon Cooperi A. Gray, Proc. Am. Acad. **20**: 307. 1885.

Orobanche ludoviciana Cooperi G. Beck, Bibl. Bot. **4**: 81. 1890.

Myzorrhiza tuberosa (A. Gray) Rydb. comb. nov.

Phelipaea tuberosa A. Gray, Proc. Am. Acad. **7**: 371. 1867.

Aphyllon tuberosum A. Gray, Bot. Calif. **1**: 585. 1876.

Orobanche bulbosa G. Beck, Bibl. Bot. **4**: 83. 1890.

Myzorrhiza pinorum (Geyer) Rydb. comb. nov.

Orobanche pinorum Geyer; Hook. Kew Jour. Bot. **3**: 297. 1851.

Phelipaea pinetorum A. Gray, Proc. Am. Acad. **7**: 371. 1867.

Aphyllon pinetorum A. Gray, Bot. Calif. **1**: 585. 1876.

Myzorrhiza Grayana (G. Beck) Rydb. comb. nov.

Orobanche comosa Hook. Fl. Bor.-Am. **2**: 92. 1838. Not *O. comosa* Wallroth. 1822.

Anoplanthus comosus Walp. Rep. **3**: 480. 1844.

Phelipaea comosa A. Gray, Pac. R. Rep. **4**: 118. 1857.

Aphyllon comosum A. Gray, Bot. Calif. **1**: 584. 1876.

Phelipaea carnosa [error] T. & G.; Coop. & Suckl. Nat. Hist. Wash. 50. 1859.

Orobanche Grayana G. Beck, Bibl. Bot. **4**: 79. 1890.

Myzorrhiza californica (Cham. & Schlecht.) Rydb. comb. nov.

Orobanche californica Cham. & Schlecht. Linnaea **3**: 134. 1828.

Phelipaea californica G. Don, Gen. Syst. **4**: 632. 1838.

Aphyllon californicum A. Gray, Bot. Calif. **1**: 584. 1876.

Myzorrhiza violacea (Eastw.) Rydb. comb. nov.

Aphyllon violaceum Eastw. Zoe **5**: 85. 1900.

Myzorrhiza xanthochroa (Nels. & Cockerell) Rydb. comb. nov.

Orobanche xanthochroa Nels. & Cockerell, Bot. Gaz. **37**: 278. 1904.

Myzorrhiza corymbosa sp. nov.

Stem 5–10 cm. high, corymbosely branched, glandular-puberulent; scales about 1 cm. long, lance-ovate, acute; bracts linear, about 1 cm. long; pedicels 5–10 mm. long; bractlets linear-subulate, half as long as the calyx; calyx-tube obconic, glandular-puberulent, 4 mm. long; lobes lance-subulate, about 1 cm. long; corolla dark purple, about 2.5 cm. long, tube 4–5 mm. wide; upper lip 7–8 mm. long, cleft about one third its length into ovate, obtuse or sometimes retuse lobes; lower lip cleft to the base into three lanceolate acutish divisions; anthers woolly.

This species has been confused with *M. californica* and *M. ludoviciana*, but is evidently most nearly related to *M. Grayana* (*Orobanche comosa* Hook.). In Hooker's Flora, the latter is described and figured as having emarginate corolla lobes. I doubt if that is a constant character. There is a fragment of Hooker's type in the Torrey herbarium; some of the lobes are evidently so, but in others this character is rather obscure. Good specimens, collected by Dr. Cooper on the Stevens' Expedition and also preserved in the Torrey herbarium, and a colored drawing, made for the report of the Wilkes' Expedition but never published, illustrate a plant with the lobes of the lower lip lanceolate, acute and entire at the apex. These and the specimen received from Hooker agree otherwise wholly in habit, size, structure, and color of the corolla. Whether the notching of the lower lobes is a specific character or not, may be decided by further field study. It is evident that the specimens cited here below are distinct enough from both. Hooker's and Cooper's plants have a corolla fully 3 cm. long, light purple and of a thinner texture, the lips are 12–15 mm. long, *i. e.*, about twice as long as in the plant here described, the upper lip is cleft to about the middle and the lobes of the lower lip are relatively narrower. The corolla of *M. corymbosa* resembles more in form, size, texture, and color that of *M. ludoviciana*, although the upper lip is less deeply 2-cleft. Occasionally one finds stunted specimens of *M. ludoviciana*, which in habit resemble this, but they can easily be recognized by the shorter calyx-lobes and the glabrous anthers. The type of *M. corymbosa* was labeled *Aphyllon californicum*, but *M. californica* is a much larger plant in every respect, and its anthers are glabrous or nearly so.

IDAHO: Reynold's Creek, July 2, 1892, *Isabel Mulford* (type, in herb. Columbia Univ.).

WYOMING: Jackson's Hole, July 30, 1901, *Merrill & Wilcox 1177*.

MONTANA: Mountains near Indian Creek, July 22, 1897, *Rydberg & Bessey 4988*.

Valeriana pubicarpa sp. nov.

Perennial, with a rootstock; stem 2–4 dm. high, finely puberulent, not bearded at the nodes; basal leaves spatulate or oblanceolate, 2–6 cm. long, thin, glabrous or nearly so; stem-leaves 2-4 pairs, the lowest pair similar to the basal ones, the rest 3–5-foliolate or the uppermost minute and simple; leaflets oblong or lanceolate, rarely elliptic, 2–5 cm. long, entire; inflorescence short and dense, corymbiform or subcapitate; flowers mostly perfect; corolla funnelform, 4–6 mm. long, more or less pubescent; limb about 4 mm. wide; fruit finely pilose, 5 mm. long, 2 mm. wide.

This species has the habit of *Valeriana occidentalis* and *V. micrantha*, but the corolla of *V. Scouleri*. From the first, it differs in the longer corolla and the pubescent fruit; from the second, in a corolla twice as long and a denser inflorescence; from the last, in the narrower entire leaflets, and the pubescent fruit; and from all in the puberulent stem, which lacks the beard at the nodes and on the sheaths. It grows in the mountains at an altitude of 2,000–3,000 m.

UTAH: Mount Nebo, Aug. 15, 1905, *Rydberg & Carlton 7717* (type, in herb. N. Y. Bot. Gard.); also Big Cottonwood Cañon, June 28, *6374* and *6517*; Provo, June 16, 1902, *Goodding 1148*.

IDAHO: Ketchum, July 23, 1892, *Miss Mulford*.

MONTANA: Lima, June 29, 1895, *Rydberg 2794*; also *C. L. Shear 3389*.

Valeriana puberulenta sp. nov.

Perennial, with a thick rootstock; stem finely puberulent, not bearded at the nodes, 1.5–3 dm. high; basal leaves spatulate, 2–5 cm. long; stem-leaves 1–3 pairs, usually 3-foliolate; terminal leaflet elliptic or oblong, or in the uppermost reduced pair lanceolate, 1–3 cm. long, the lateral ones oblong or lanceolate, about half as long; plant usually polygamo-dioecious; inflorescence of the essentially pistillate plant dense-corymbiform, that of the somewhat smaller essentially staminate plant subcapitate; corolla funnelform, 4–5 mm. long; limb 2.5–3 mm. wide; fruit glabrous, nearly 5 mm. long and 2 mm. wide.

This species has the pubescence of the preceding, but differs in the smaller stature, the smaller flowers, fewer and smaller leaves, glabrous fruit and a stronger tendency to be polygamo-dioecious. It grows in the mountains of Utah, at an altitude of 2,000–3,000 m.

UTAH: Mountains north of Bullion Creek, near Marysvale, July 23, 1905, *Rydberg & Carlton 7065* (type, in herb. N. Y. Bot. Gard.); also Big Cottonwood Cañon, June 28, *6390*, *6371*, and *6532*; Mount Barette, July 26, *7238*; near Alta, July 10, 1883, *Leonard 177*; Central Utah, 1875, *Parry 36*; Wahsatch Mountains, Aug., 1869, *S. Watson 488*, in part.

CORRECTION

Mertensia cana Rydb. nom. nov.

Mertensia canescens Rydb. Bull. Torrey Club **31**: 640. 1904. Not *Mertensia canescens* Kaulf. 1824.

Professor T. D. A. Cockerell has called my attention to the fact that my *Mertensia canescens* is antedated by *M. canescens* Kaulf., a fern.

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Contribution No. 130

MONOGRAPHIA

GENERIS ARTHROCLIANTHI BAILL.

AUCTORE

B. P. G. HOCHREUTINER, Dr sc.

Conservateur du Conservatoire botanique
Privat-docent à l'Université de Genève

Paru le 15 août 1909

ÉDITION ATAR
Corraterie, 12
GENÈVE 1909

Tiré à part de l'*Annuaire du Conservatoire et du Jardin Botaniques de Genève*, 13^{me} année, 1909, p. 30-46.

(Extrait de l'Annuaire du Conservatoire et du Jardin Botaniques de Genève, T. XIII, 1909.)

MONOGRAPHIA GENERIS

ARTHROCLIANTHI BAILL.

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Paru le 15 Août 1909.

Arthroclianthus Baill. in *Adansonia* IX, 296 (1870) emend. Hochr. (e § *Hedysareae* et §§ *Desmodiinae*). — Plantae lignosae. Folia spiraliter disposita, pinnatim 3-foliolata, foliola petiolulata, petioluli laterales ad articulationem reducti, petiolulus terminalis longior, apice solum articulationem gerens; stipulae binae parvae, acutae, stipellis deficientibus. Flores in racemos axillares dispositi; bracteae breves, plerumque distichae; bracteolae 2, parvae arcuatae, summo pedicello sub flore insertae et persistentes quando flores caduci. Flores papilionacei. Calyx gamophyllus, sepala dua superiora concrescentia ita ut calyx 4-lobus videtur, lobis tribus inferioribus minoribus. Vexillum alis carinaque brevius, saepius erectum vel reflexum et interdum refractum. Alae plerumque falcatae, saepe cum carina adhaerentes. Carina arcuata, rostrata, plerumque valde producta; petala omnia plerumque unguiculata. Stamina 10, diadelpha, (9 + 1), inaequilonga, 5 longiora et 5 paulum breviora alternantia; antherae oblongae, ± dorso insertae.

Ovarium stipitatum, elongatum, multiovulatum ; stylus gracilis, apice in stigma ± incrassatum abiens. Legumen saepius stipitatum, basi calyce persistente cinctum, lineare, valde elongatum, compressum, ∞-articulatum, articulis oblongis, monospermis, articulum apicale stylo persistente longe apiculatum.

* * *

Jusqu'à présent, le genre *Arthroclianthus* n'a pas été situé exactement dans la famille des *Légumineuses*. Il est évident que c'est une *Papilionacée* et il semble bien qu'on doive le rattacher au groupe des *Hedysarées*. Mais, à cause de l'absence de stipelles, il paraît ne rentrer qu'avec peine dans la sous-tribu des *Desmodinées*, telle que la définit Taubert (in Engler u. Pr. *Nat. Pfl.* III, III, p. 309). En tous cas, le genre *Arthroclianthus* n'est pas à sa place, quand on le range à côté de *Hallia* et de *Lespedeza* (comme le fait Taubert l. c. p. 331).

Le rapprochement avec les genres *Hallia* et *Lespedeza* est dû au fait de l'absence de stipelles dans les trois groupes. L'auteur paraît y attacher une certaine importance, parce que la présence des stipelles est constante chez les autres *Desmodinées*.

Or, ce caractère paraît être de peu de valeur dans le cas particulier, comme on le verra plus loin, et le rapprochement avec *Hallia* et *Lespedeza* est tout-à-fait artificiel. Ces deux derniers genres ont : Un calice à 5 lobes réguliers, des ailes et une carène ne dépassant jamais l'étendard, l'étamine médiane souvent soudée avec les autres et un fruit ± sphérique, toujours uniséminé et indéhiscent. Non seulement ces caractères sont en contradiction absolue avec les *Arthroclianthus*, mais encore le port de ces plantes est complètement différent, et leur patrie est fort éloignée de la Nouvelle-Calédonie, où les *Arthroclianthus* semblent être endémiques. Les *Hallia* sont au Cap, et les *Lespedeza* dans l'Amérique du Nord et dans l'Asie orientale ; une seule espèce pénètre jusqu'en Australie.

Nous pensons que Bentham et Hooker, qui n'ont pas connu les *Arthroclianthus*, ont mieux tenu compte des affinités des *Hallia* et *Lespedeza*, en les classant à part, avec d'autres genres, possédant un ovaire uniovulé.

Cependant les *Arthroclianthus* doivent être placés parmi les *Desmodinées* et, quoiqu'ils soient dépourvus de stipelles, ils doivent être rangés à côté des *Ougeinia*, qui en possèdent, mais qui sont extraordinairement voisins des *Arthroclianthus*. Le port, l'apparence des inflorescences et surtout cette concrescence si caractéristique des 2 sépales supérieurs, rappellent tellement notre genre, qu'on serait tenté de réunir le tout, n'était la présence des stipelles chez les *Ougeinia*.

Or, précisément cette analogie, qui ne laisse aucun doute dès qu'on a comparé les deux premiers échantillons venus, nous fait croire que ce caractère des stipelles pourrait être supprimé peut-être avantageusement de la diagnose de la sous-tribu. Il deviendrait alors, tout au plus, un caractère générique, car l'on peut dire hardiment que les *Arthroclianthus* sont des *Ougeinia* dépourvus de stipelles.

En outre, placé à côté des *Ougeinia*, notre genre aura l'avantage d'être dans le voisinage immédiat des *Desmodium*, qui présentent aussi une concrescence plus ou moins marquée des sépales supérieurs, et dont le fruit ressemble tant à celui des *Arthroclianthus*. Au point de vue de la valeur systématique, cette concrescence nous paraît peut-être plus importante que les stipelles ; il en est de même aussi pour l'allongement de la carène et des ailes qui dépassent parfois de beaucoup la longueur de l'étendard. Ces caractères semblent plus ou moins liés entre eux ; en les recherchant chez d'autres *Papilionacées*, nous avons vu qu'ils étaient souvent réunis.

Par exemple, les *Mucuna*, parmi les *Phaséolées*, ont aussi une carène et des ailes proéminentes et ils présentent également une soudure des deux sépales supérieurs ; leur style est capité et les étamines, diadelphes, sont inégales, (5 longues et 5 courtes) comme chez les *Arthroclianthus* et chez les *Ougeinia*. Pour compléter la ressemblance, leur fruit est aussi un peu retréci entre les graines et il présente des septum intérieurs qui séparent les graines les unes des autres.

L'affinité, signalée par Baillon, avec les *Donia* (= *Clianthus*) est toute superficielle, car ce genre ne présente, ni l'allongement des ailes et de la carène, ni la concrescence des sépales supérieurs, ni le fruit caractéristique des *Arthroclianthus*. La ressemblance avec les *Chadsia* est un peu plus marquée, mais elle est fort lointaine aussi.

En résumé, nous proposons de placer les *Arthroclianthus* à côté du genre *Ougeinia*, dans le voisinage immédiat des *Desmodium*, en rappelant qu'il a quelques ressemblances avec certaines *Phaséolées*.

*
* *

Baillon a donné une bonne diagnose de ce genre dans l'*Adansonia* (IX, p. 296, ann. 1870). Il le croyait monotypique et il le décrivit d'après une plante de F. v. Muller.

Nous avons découvert une demi-douzaine de nouvelles espèces, bien caractérisées, appartenant à ce genre, parmi des plantes de l'Herbier de New-York, récoltées par Vieillard et Deplanche en Nouvelle-Calédonie. C'est pourquoi nous avons entrepris d'en faire une rapide monographie.

Baillon dit bien dans son article, qu'il se souvient d'avoir vu, parmi les collections de Vieillard et Pancher, plusieurs spécimens ressemblant à son *Arthroclianthus* et nous ne doutons pas qu'il ait pensé à plusieurs des espèces décrites ci-aprés. Il a dù en voir un certain nombre dans la collection de Nouvelle-Calédonie du Museum de Paris, où nous avons aussi relevé leur présence. Cependant, aucune des plantes que nous avons sous les yeux, ne répond à la description donnée par Baillon pour l'*A. sanguineus*. Deux d'entre elles doivent lui ressembler, ce sont : *A. Deplanchei* et *A. microbotrys*.

L'*A. Deplanchëi* s'écarte de l'*A. sanguineus* par ses jeunes tiges nettement velues, ses folioles arrondies à la base, ses pédicelles plus courts que le rachis des feuilles et ses fleurs, atteignant à peine 3 cm. de long. Tandis que Baillon décrit l'*A. sanguineus* : Ramis glabris... folia basi saepius angustata... pedicellis rachi aequalibus vel longioribus... flores ad 4 cm. longi.

Le second diffère aussi de l'*A. sanguineus* par ses feuilles pourvues, à leur partie inférieure, de petits poils apprimés et très disséminés, par ses pédicelles plus courts que le rachis des feuilles, par ses fruits délicatement mais très distinctement velus, devenant même tomenteux à leur base et sur les septum, entre les segments, et enfin par ses fleurs qui paraissent être encore plus petites que chez l'*A Deplanchei*. Au contraire, la description de Baillon dit : « Foliis glabris... pedicellis rachi aequalibus v. longioribus... legumen glabrum. »

Au reste nous n'éprouvons aucune difficulté à admettre que l'espèce de Baillon est bien distincte de toutes les nôtres, parce que nous croyons que ce genre est très polymorphe. Par exemple, le n. 2546 de Vieillard, provenant de Kanala, est, sans aucun doute aussi, une espèce particulière, n'ayant pas de ressemblance avec le n. 327 de Deplanche. C'est donc une erreur d'avoir réuni ces deux spécimens, lors de la distribution, comme ce fut le cas dans la série de l'Herbier de New-York.

Cette dernière espèce, — Deplanche n. 327 — qui ressemble aussi un peu à l'*A. sanguineus* Baill., ne nous est connue que par son fruit et par un spécimen assez défectueux, de sorte que nous avons renoncé à la décrire. Nous mentionnons ici son existence pour montrer le polymorphisme du genre.

Nous basant sur nos propres observations et sur la description de Baillon, nous proposons la clef analytique suivante :

Clavis analytica

1 {
Inflorescentiae longae, nutantes, rachi[1] et etiam (interdum) folio longiores ; foliola oblonga, glabra : 2. *A. macrobotryosus* Hochr.
Inflorescentiae mediocres, erectae, rachi parvo folii longiores, sed folio breviores ; foliola oblonga, subtus dense sericea : 1. *A. sericeus* Hochr.
Inflorescentiae breves, rachi folii multum breviores ; foliola glabra : 2.

2 {
Foliola anguste lanceolata ; pedicelli glabri ; calyx subglaber : 3. *A. angustifolius* Hochr.
Foliola oblonga ; pedicelli et calyces semper ± pilosi (in *A. sanguineo* indumentum calycis et pedicellorum ignotum) : 3.

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[1] Nous appelons *rachis*, comme l'entendait sans doute Baillon, toute la région comprise entre la base du pétiole et le sommet de l'articulation de la foliole terminale.

3 Fructus glaber : 4.
Fructus ± pilosus : 5.

4 Rami novelli pilosi ; foliola basi ± rotundata nec attenuata ; flores 2,5—3 cm. longi : 5. *A. Deplanchei* Hoehr.
Rami glabri ; foliola basi attenuata ; flores 4 cm. longi. 7. *A. sanguineus* Baillon. in *Adansonia* IX, 296 (1870)

5 Foliola obovata, plana, apice rotundata ; petiolus brevissimus, i. e. foliola paria fere rachis basi inserta : 6. *A. obovatus* Hoehr.
Foliola oblonga, apice acuminata sed obtusa, margine ± undulata ; petiolus longus, id est foliola paria supra medium rachis inserta : 4. *A. microbotrys* Hoehr.

Au premier abord, plusieurs de ces espèces peuvent être distinguées de toutes les autres par quelque caractère spécial qui leur est particulier. C'est pourquoi nous pensons être utile en le mentionnant ici :

A. macrobotryosus est la seule espèce qui possède des inflorescences très allongées et nutantes.

A. angustifolius, seul, a des folioles lancéolées linéaires, très étroites, avec des pédicelles glabres et un calice presque glabre.

A. sericeus, seul, a des feuilles recouvertes d'une villosité dense.

A. sanguineus, seul, a des sépales obtus, d'après la description.

A. obovatus a seul des feuilles obovées et des pétioles beaucoup plus courts que le pétiolule de la foliole médiane.

A. obovatus, *microbotrys* et *Deplanchei* ont tous un long gynophore à la base du fruit.

DESCRIPTIONS DES ESPÈCES

1. **Arthroclianthus sericeus.** Hochr. sp. nov. — Caules lignosi ± cylindrici, cortice nigro obtecti et pilis parvis albis adpressis tomentosi ; caules novelli, compresso-ancipites, virides et etiam densius pilosi. Folia alterna, densa, trifoliolata, stipulis duabus minimis, triangularibus, dentiformibus praedita. Petiolus brevis, fere ad articulationem reductus, ut petioluli dense sericeus et ± cylindricus ; petiolulus folioli terminalis longior quam petiolus communis ; petiolulus foliolorum lateralium ad articulationem reductus. Foliolum terminale lateralibus majus ; foliola omnia coriacea, oblonga, basi rotundata vel ± attenuata, apice rotundata et interdum subretusa, margine integerrima et paululum revoluta, supra nitentia, saturate viridia, sparce et adpresse pilosa, praecipue in juventute, sed serius calvescentia, subtus dense sericea, in nervaturis ut in articulationibus ± ferrugineo-nitentia, in parenchymati ut rachis et axes ± argenteo-nitentia ; limbus penni- et eleganter reti-nervis, nervis, praecipue subtus, prominentibus ; nervi secundarii utrinque circa 5-6. — Inflorescentiae multiflorae, axillares, racemosae, erectae, folio minores sed rachi multum longiores ; pedicelli erecti ; pedunculi et pedicelli ut caules dense sericei ; bracteae minimae, fere obsoletae ; bracteolae duae ut in genere summo pedicello, sub flore insertae ; flores parvi, circa 10-20 in inflorescentia. Calyx gamophyllus, turbinatus, extus dense sericeus, intus glaber, ore 4-lobus, lobis inaequalibus, dorsale majore, omnibus subulatis, acuminatis, acutis, sinubus ± rotundatis. Corollae partes subaequilongae, glabrae. Vexillum subcirculare, unguiculatum ; alae fere rectae, longe unguiculatae et apice unguiculi dente arcuato praeditae ; carina alis paululum longior sed vexillo circa aequilonga, arcuata, apice obtusa, basi ut alae longe unguiculata. Stamina diadelpha (9+1), superiore plane libero, ceteris in tubum glabrum apice arcuatum coalescentibus. Ovarium elongatum, dense sericeum ; stylus arcuatus, basi sericeus, apicem versus glabrescens et apice stigma capitellatum gerens. Legumina juniora solum vidi, dense sericea lomentacea, 2-3 segmenta gerentia, basi gynophoro brevissimo

et apice stylo persistente praedita. Calyx et interdum corolla diu persistentes.

Internodia in ramis junioribus 0,5—1,2 cm. longa. Folia tota 5—7 cm. longa. Petioli ca. 0,5 cm. longi; petioluli foliolorum lateralium ca. 0,3 cm. longi, petiolulus folioli apicalis 0,7—0,8 cm. longus. Lamina foliolorum lateralium 2,2×0,9—4×1,8 cm. folioli apicalis 3,7×1,8—5,5×2,2 cm. longa et lata. Inflorescentiarum axis primarius 2,5—3,5 cm. longus; pedicelli 0,3—0,4 cm. longi. Flos ca. 1,1 cm. longus. Calycis tubus ca. 0,25 cm. longus, lobi vix 0,2 cm. longi. Vexilli lamina ca. 0,7×0,7 cm. longa et lata, unguiculum ca. 0,25 cm. longum; alae cum unguiculo ca. 0,9 cm. longae et 0,25 cm. latae; carina cum unguiculo ca. 1 cm. longa. Tubus stamin. ca. 1 cm. longus, filamenta libera vix 1 mm. longa. Legumen junius, cum stylo persistente 0,8 cm. longo, ca. 2,8 cm. longum et 0,3 cm. latum; jugis inter segmenta vix plus quam 1 mm. latis. Segmenta senioria ad 1×0,5 cm. longa et lata.

Hab. — Nova Caledonia. Pum (Deplanche ann. 1861-67, n. 328) in Hb. New-York.

2. **Arthroclianthus macrobotryosus** Hochr. sp. nov. — Caules lignosi, cylindrici, cortice brunneo; novelli pilis adpressis brunneis pubescentes, seniores parce pilosi vel glabrescentes Folia alterna, ± densa, trifoliolata; stipulae parvae, subulatae, e basi acuminatae. Petiolus longior quam in spec. praec., folioli terminalis petiolulo ± aequilongus, ut petioluli ± dense pilosus; petioluli foliolorum lateralium ad pulvinos motores cylindricos reducti; lamina foliolorum papyracea, latitudine variabilis, oblonga, basi regulariter cuneata, apice ± acuminata, acumine obtuso, margine integra et interdum crispula, utrinque apparenter glaberrima, sed vero pilis minimis, adpressis, sparcis, praecipue in nervaturis et praecipue facie inferiore insertis, praedita; lamina interdum ± discolor, penninervis et eleganter reticulata; nervis et nervaturis utrinque, sed praecipue subtus, prominentibus. — Inflorescentiae multiflorae, racemosae, axillares, longae, nutantes, folio longiores; axis pilosus, ferrugineus, fere e basi floriferus; pedicelli floriferi refracti, minute pilosi; bracteolae duae, sub flore insertae et bracteae minimae, filiformes. Flores

mediocres, 20-50 in inflorescentia. Calyx gamophyllus, anguste campanulatus, extus minutissime puberulentus, intus, praeter apicem loborum minutissime tomentellum, glaber; lobi 4, *tubo breviores*, dorsalis latior triangularis, tres ventrales angustiores ± acuminati, sinubus acutis. Corollae partes subaequilongae, glabrae, demum carina vexillo paulum longior. Vexillum oblongum, breviter unguiculatum; alae falciformes, longe unguiculatae, apice unguiculi dente retroverso nec arcuato praeditae; carina arcuata, alis paululum longior, apice acuta, basi longe biunguiculata, ut alae apice unguiculorum dente praedita. Stamina (9+1) diadelpha, superiore plane libero, cetera in tubo glabro coalita; tubus quam in specie praecedente pro rata brevior: antherae oblongae, dorsifixae; filamentibus liberis pro rata longis; filamenta e loco incurvationis libera. Ovarium dense sericeum, in stylum arcuatum apice glabrum et stigma minimum gerentem, attenuatum. (Fructus, vel ignotus, vel e n. 2549 descriptus: lomentaceus, 1-3 vel plus segmenta gerens, pilis parvis ferrugineis erectis, in segmentibus sparsis, in articulationibus densis, praeditus; gynophorus fere obsoletus, calyx persistens.)

Internodia ± elongata; petioli 1—2 cm. longi; petioluli laterales 0,3—0,4 cm. longi, medianus 1—2 cm. longus; lamina folioli terminalis 7×3—7×4—4×2,5 cm. longa et lata et interdum minor, foliolorum lateralium 6,2×2,2—5,5×3—4,5×2,2 cm. longa et lata et interdum minor. Inflorescentiae, quas vidi 6—12 cm. longae; bracteae vix 0,1 cm. longae; pedicelli adulti ca. 0,7 cm. longi. Calyx totus ca. 0,6 cm. longus, lobis vix 0,2 cm. longis. Vexilli unguiculum 0,15 cm. longum, lamina ca. 0,9×0,7 cm. longa et lata; alae ca. 1,1 cm. longae, unguiculo ca. 0,35 cm. longo; carina, cum unguiculis 4 mm. longis, ad 1,25 cm. longa. Tubus staminalis ca. 0,9 cm. longus, filamenta libera 2 mm. longa. Ovarium ca. 0,8 cm. longum; stylus ca. 0,3 cm. metiens. (Fructus ± longus, segmentibus 0,9×0,5—1,5×0,5 cm. longis et latis. Articulationes interdum paulum evolutae et interdum ad 0,3×0,4 cm. longae et latae).

Hab. — Nova Caledonia, Wagap (Vieillard ann. 1861-67, n. 2550) in Hb. New-York et Kew. — Id. (Vieillard n. 2549 pro parte) in Hb. New-York; l'identification de ce dernier specimen n'est pas

tout-à-fait sûre, parce qu'il est incomplet, aussi fera-t-on bien de considérer comme type le premier numéro cité.

Obs. — Nous ne sommes pas absolument certain que Vieillard n. 2549 appartienne à la même espèce, parce que le n. 2550 porte des fleurs et pas de fruits, et que le n. 2549 porte des fruits et pas de fleurs.

Sur la feuille portant le n. 2549 de Vieillard, il y a, dans l'Herbier de New-York 3 specimens : 1° *un*, avec fruits, qui semble bien être l'A. *macrobotryosus*, parce qu'il a le même port que le type et de longues inflorescences, portant un petit nombre de fruits ; 2° *deux* branches, portant des bourgeons floraux très jeunes, attachés à un axe d'inflorescence extrêmement court.

Si le n° 1 est bien l'A. *macrobotryosus*, alors, sans aucun doute, les deux spécimens n° 2 appartiennent à une autre espèce, car nous avons vu sur le type (n° 2550) des fleurs en boutons de l'A. *macrobotryosus*, ayant à peu près le même âge, et qui sont d'une forme bien différente. En outre, si nous comparons de jeunes inflorescences arrivées à peu près au même stade de développement, chez le type et dans les spécimens n° 2 de Vieillard 2549, nous constaterons qu'elles sont beaucoup plus longues chez le type.

Dans le cas où les spécimens n° 2 de Vieillard 2549 seraient une espèce distincte, il est inopportun de la décrire avec un matériel aussi incomplet.

Toutefois la possibilité que l'ensemble des spécimens réunis sous le n° 2549 appartienne à la même plante n'est pas exclue. Dans cette dernière hypothèse, il faudrait admettre que les inflorescences très courtes des spécimens n° 2 (mesurant à peine 2 cm.) sont fortement accrescentes et qu'elles atteindront plus tard une longueur de 7 cm. comme dans le spécimen n° 1.

Comme cette dernière supposition nous paraît moins vraisemblable que la première, nous rattacherons provisoirement le spécimen n° 1 à l'A. *macrobotryosus*. En outre, afin d'éviter les confusions, nous avons basé notre description exclusivement sur Vieillard n° 2550 et nous avons mis entre parenthèses la description du fruit, empruntée au n° 2549, 1°.

3. **A. angustifolius** Hochr. sp. nov. — Caules lignosi, cylindrici, cortice brunneo vel griseo, glabro obtecti; novissimi, brevissimi, i. e. partes fere etiam in alabastris parce et minutissime tomentellae. Folia sparsa, trifoliolata, alterna vel spiraliter disposita ut e cicatriciis foliaribus patet; stipulae parvae, triangulares, glabrae. Petiolus circa ut in specie praecedenti longus, petiolulo mediano fere aequilongus; petioluli laterales et articulationes glabri; lamina foliolorum lanceolata, basi attenuata, apice longe attenuata vel subacuminata, imo apice rotundata, margine integra, distanter penninervis, supra subtusque paulum elevato-reticulata et glabra, paululum discolor. — Inflorescentiae racemosae, axillares; axis primarius brevissimus, circa petioli dimidiam longitudinem aequans, adpresse et minute pilosus, bracteas parvas ca. 9, alternantes, imbricatas, vaginantes, dorso elevato-nervosas et glabrescentes, margine et apice praecipue in juventute ciliatas, gerens; pedicelli graciles, minutissime et parcissime pilosi, fere glabri, axi primario duplo vel triplo longiores. Flores quam in specie praecedenti multum majores, sed, sub anthesi, unus vel duo solum in inflorescentia evoluti; bracteolae sub flore duae, dentiformes, parvae. Calyx ± campanulatus, lobis 4, latis, tubo multum brevioribus, irregularibus, praeditus; lobo uno maximo, late rotundato, lobis tribus parvis, triangularibus; calyx extus parcissime pilosus, intus glaber. Corollae partes inaequilongæ; carina valde prominente. Vexillum ± oblongum, apice acuminato-acutum nec unguiculatum; alae falciformes, fere sessiles et longe attenuatae; carina circa medio satis abrupte arcuata, apicem versus attenuta, alis et vexillo longior. Tubus staminalis circa in altitudine incurvationis filamenta inaequilonga gerens. Ovarium fusiforme, dense et adpresse argenteo-sericeum, stylum longum, basi ± sericeum et apicem versus glabrum, gerens. Stigma non vidi; fructus ignotus.

Petioli 1—1,5 cm. longi; petioluli mediani 0,6—1,4 cm. longi, laterales 0,2—0,3 cm. longi; foliola lateralia 4,5×1,1—6,2×1,5 cm. longa et lata; foliola terminalia 5×1,3—8,8×1,7 cm. longa et lata. Inflorescentiae axis primarius 0,5—0,8 cm. longus; pedicelli 0,9—1 cm. longi. Flos ca. 2,5 cm. longus. Calyx 0,5—0,6 cm. longus. Vexillum ca. 1,5 cm. longum vel plus; alae ad 2 cm. longae ; carina 2,5 cm. longa et ca. 0,3—0,5 cm. lata. Stamina ca. 2,2 cm. longa.

Hab. — Nova Caledonia, Ouellon (Vieillard 1866-67, n. 2547) in Hb. New-York et in Hb. Musei paris.

Obs. — Nous n'avons pas vu le fruit de cette espèce, mais nous sommes certain qu'elle appartient aussi au genre *Arthroclianthus*. Elle se distingue des autres espèces par ses folioles étroites et par ses pétales sessiles. La forme des inflorescences est remarquable, elles ressemblent à de minuscules cônes de sapin et portent en général seulement une fleur à la fois. J'ignore si les autres fleurs se développent plus tard. Une seule chose est certaine, c'est que les bourgeons floraux sont là, entre les bractées, mais ils sont si petits, qu'on les distingue à peine.

4. **Arthroclianthus microbotrys** Hochr. sp. nov. — Probabilissime arbor; ramuli divaricati, cylindrici, glabri, superne cortice griseo, inferne brunneo obtecti. Folia spiraliter disposita, trifoliolata, praeter pilos, difficillime visibiles, in facie inferiore laminae sparsos, adpressos, glaberrima ; stipulae parvae, triangulares, mature siccitate rumpentes. Petiolus petiolulo mediano vix aequilongus ; petioluli laterales ad articulationem reducti, omnes ut articulationes glabri ; lamina foliolorum papyracea, oblonga vel ovato-oblonga, acuminata, acumine obtuso vel retuso, basi ± attenuata, acuta, margine integra et saepe undulato-crispatula, penni- et eleganter reti-nervis, nervis lateralibus utrinque 8-9, nervis omnibus utrinque paululum prominentibus, lamina paululum discolor ; foliolum terminale foliolis lateralibus paulum majus sed conforme. Folia eis A. *macrobotryosi* similia, i. e. utrinque apparenter glabra, sed vero pilis adpressis paucis praecipue in nervaturis et praecipue facie inferiore insertis praedita. — Inflorescentiae racemosae, axillares et terminales, pauciflorae ; axis primarius minutissime pilosus, brevis, quando axillaris, petioli longitudinem aequans vel vix aequans, bracteas 7-9, alternantes, triangulares, vaginantes, dorso elevato-nervosas, glabrescentes, apice mature siccas et rumpentes gerens. Pedicelli graciles, axi primario fere aequilongi, ± compressi, puberuli, et apice, sub flore, bracteolas duas, lanceolatas, parvas gerentes. Calyx.

urceolatus, viridis, extus adpresse pilosus, intus glaber, lobis 4, latis, tubo multum brevioribus, irregularibus praeditus; lobus dorsalis e lobis duobus concrescentibus formatus, maximus, obtusus; ceteri tres triangulares, acuti. Corollae partes inaequilongae, sed non valde inaequilongae; carina longissima, alae brevissimae, vexillum intermedium. Vexillum anguste oblongum, fere lanceolatum, acutum, plerumque arcte plicatum; alae vix arcuatae, ± acuminato-obtusae; carina fere non arcuata; partes omnes breviter unguiculatae. Tubus stamineus glaber, fere rectus, apice 9 filamenta brevia gerens; antherae oblongae: stamina 5, paululum longiora et 5, paululum breviora. Ovarium dense sericeum, in stylum apicem versus glabrescentem et paulum arcuatum abiens. Fructus lomentaceus, 4-8 segmenta gerens; gynophorus longus, pedicello plerumque longior, hirsutus, basi calycem et corollam subpersistentes gerens; segmenta elongata, elliptica, tomentella et insuper pilis longis, setaceis, sparsis, adpressis praedita.

Petioli 0,7—1,4 cm. longi; petioluli laterales ca. 0,25 cm. longi, medianus 0,8—1,4 cm. longus; lamina foliolorum lateralium 4,5×2,5—5,6×2,9 cm. longa et lata; lamina foliolorum terminalium 5,5×3—8×4,5 cm. longa et lata. Inflorescentiae axis 0,7—1,2 cm. longus; pedicelli floriferi ca. 0,7 cm. longi, fructiferi ad 1,2 cm. longi. Calyx junior ca. 3 mm. prob. ad. 5 mm. longus, lobis vix 1 mm. longis. Vexillum ca. 1,2 cm. longum et vix 0,7 cm. latum; alae ca. 1 cm. longae; carina ca. 1,4 cm. longa. Gynophorus in fructu 1—2 cm. longus; leguminis segmenta 2×0,75—2,5×0,8 cm. longa et lata; septa 0,2—0,5 cm. lata et, quando angusta, interdum ad 0,3 cm. longa.

Hab. — Nova-Caledonia, Wagap (Vieillard ann. 1861-67, n. 2551) in Hb. New-York et in Hb. Kew.

Obs. — Cette espèce a une très grande ressemblance avec l'*A. macrobotryosus*, dont elle possède la texture des feuilles, l'indument en général et la forme des fruits. Elle en diffère par ses inflorescences très courtes, comme celles de l'*A. angustifolius* et par la présence d'un long gynophore, ou plutôt carpophore, qui porte le fruit, comme chez l'espèce suivante.

5. **A. Deplanchei** Hochr. sp. nov. — Rami lignosi, ± cylin-

drici et cortice griseo obtecti; novelli pilis minutissimis adpressis praediti. Folia spiraliter disposita, trifoliolata; stipulae triangulares, parvae, mox rumpentes. Petioli petiolulum medianum fere aequantes, petioluli laterales ad articulationes reducti; omnes, praeter articulationes parce pilosas, fere glabri; lamina foliolorum oblonga ovatave, apice, vel obtusa, vel retusa, vel acuminata acumine obtuso retusove, basi ± rotundata, margine integra, utrinque glabra, elevato-penni- et reti-nervia et fere nitens. Foliolum terminale majus et saepius oblongum, lateralia minora et saepius ovata. — Inflorescentiae axillares, racemosae, breves, multiflorae; axis primarius petiolo brevior, ut bracteae dorso dense et adpresse pilosus; bracteae parvae, triangulares, vaginantes, numerosae, spiraliter dispositae nec alternantes; pedicelli floriferi, 1 vel plus in axilla bracteae, pubescentes, ± cylindrici, rachi foliorum multum breviores, apice bracteolas duas, subulatas, sub flore magno, gerentes. Calyx urceolatus, extus puberulus et adpresse pilosus, intus glaber, lobis latis, 4, inaequalibus, tubo multum brevioribus praeditus; lobus maximus e duobus concrescentibus multum latior, sed omnes triangulares, acuti. Corollae partes valde inaequales, carina valde prominente. Vexillum late oblongum, acutum et complicatum, sed ad trientem inferiorem plicatione abrupta ut aureola concava versus calicem refractum, et cucullam magnam apertam aemulans; pars complicata vexilli corollae basin amplectens; alae lanceolatae, acutae, carina multum breviores; carina longissima et latissima, oblonga, acuminata, i. e. rostrata; corollae partes, praeter carinam intus adpresse pilosam, omnes glabrae; alae et carina longe, vexillum breviter, unguiculatæ. Tubus fissus stamineus, extus glaber, in parte carinae rostrata in filamentibus divisus. Ovarium dense sericeum, apice in stylum longum, valde prominentem et — in parte prominente — glabrum abiens. Stigma parvum, truncatum.

Petioli 1—1,8 cm. longi; petioluli mediani 1—1,4 cm. longi; petioluli laterales 0,2—0,4 cm. longi; lamina foliolorum lateralium 2,7×1,4—3,1×2,4—5,3×2,4 cm. longa et lata; lamina foliolorum terminalium 4×1,9—6,8×3,1—6×3,3 cm. longa et lata. Inflorescentiae axis 0,5—0,9 cm. longus; pedicelli floriferi 1—1,1 cm. longi. Flores ca. 3 cm. longi. Calyx 0,5—0,6 cm. longus, lobis

1—2 mm. longis. Vexillum ca. 1,5 cm. longum et 1,5 cm. latum; pars complicata ca. 0,5 cm. longa, pars cucullata ad 1 cm. longa; alae ca. 2 cm. longae et 0,4 cm. latae; carina ad 2,8 cm. longa et 0,6 cm. lata. Tubus stamineus vix 2 cm. longus, stamina carinam aequantia. Stylus carinam ad 0,4 cm. excedens.

Fructus descriptio e specimine *b* sumpta :

Pedicelli fructiferi minute pilosi, 1,3—1,5 cm. longi; calyx persistens ejusdem formae quam in specimine *a*. Gynophorus, 1,6—2 cm. longus, glaber; fructus lomentaceus, segmenta verisimiliter multa, — basilaria solum vidi — oblonga, glabra, coriacea, margine incrassata, ca. 1,4×0,45 cm. longa et lata; septa 1—1,5 mm. lata. (Folia in specimine *b*, paulum minora et consistentia crassiore sed ejusdem formae. Petioli 0,7—1,4, petioluli mediani 0,5—1 cm. longi; lamina foliolorum lateralium 1,8×1,1—3,1×1,6, foliolorum terminalium 3,8×1,8—4,1×2,2 cm. longa et lata).

Hab. — Nova Caledonia, Taulé (Deplanche n. 325 *a* et *b*) in Hb. New-York et (Deplanche n. 325) in Hb Kew. — (Pancher n. 42) in Hb. Kew. probab. species identica. Typus est Deplanche n. 325 *a*.

Obs. — La feuille de l'Hb. de New-York portant le nº 325 de Deplanche, contient deux spécimens que j'ai appelés *a* et *b*. Ma description fut faite d'après le spécimen *a* qui ne possède pas de fruits, mais qui a des fleurs bien développées.

Comme le spécimen *b*, qui porte des fruits, est légèrement différent du spécimen *a*, j'ai préféré maintenir les deux descriptions séparées, afin d'éviter les confusions. Je tiens à dire cependant, qu'il n'y a aucune raison de croire que ces deux branches aient été coupées sur des arbres différents et que l'apparence générale, un peu divergente, pourrait provenir du fait que les deux branches ont été coupées en deux expositions différentes.

Sur la part de Kew, portant le même nº, il y a aussi deux spécimens, dont l'apparence correspond exactement à ceux de l'Hb. de New-York. Celui qui portait des feuilles plus petites et des fruits, portait alors aussi des fleurs et j'ai noté qu'elles étaient tout-à-fait semblables à celles de mon spécimen *a* de l'Hb. de New-York.

6. **Arthroclianthus obovatus** Hochr. sp. nov. — Arbor vel frutex; rami ± tortuosi, ± cylindrici, cortice griseo-viride,

crebre lenticellato, obtecti; novelli minute tomentelli. Folia alterna (an regulariter?), trifoliolata, satis crebre disposita; stipulae binae, parvae, scariosae, triangulares, acuminatae. Petiolus ut in A. *sericeo* fere ad articulationem reductus, petiolulus medianus pro rata longus, fere glaber, laterales ad articulationes reducti; articulationes hirtelli; lamina foliolorum omnium coriacea, obovata, vel oblongo-obovata, apice rotundata vel interdum subemarginata, basi attenuata, margine integerrima, supra fere nitens, subtus obscura, utrinque elevato-penni- et laxe reti-nervis, glaberrima; foliolum terminale lateralibus majus; nervi secundarii principes utrinque ca. 6. — Inflorescentia pauciflora, axillaris (an semper?); axis primarius brevissimus, ferrugineo-pilosus; bracteae dentiformes; pedicelli parcissime pilosi, pro rata longi, apice sub flore bracteolis duabus, dentiformibus, minimis, praediti. Florem defloratum solum vidi. Calyx campanulatus persistens, extus adpresse pilosus, intus parte inferiore glaber, parte superiore minutissime pilosus, margine 4-lobatus; lobi ovati, 3 inferiores acuti; lobus superior, e duobus lobis concrescentibus efformatus, major, apice rotundato-emarginatus. Corollam non vidi. Columna staminalis longa, arcuata, apice in novem filamenta fissa; stamen solitarium probabile reliquis paululum brevius. Ovarium lineare, dense et adpresse sericeum, basi in gynophorum, apice in stylum longum glabrumque, attenuatus. Stigma truncatum, paululum incrassatum. Fructus lomentaceus, basi gynophoro longo, parte inferiore glabrescente, parte superiore sericeo, praeditus et apice stylo persistente coronatus. Segmenta, oblonga, papyracea, 6-10, parcissime et adpresse pilosa, septis brevissimis, abruptis, sericeis, separata.

Petioli communes 0,2—0,3 cm. longi; petioluli mediani 0,5—0,9 cm. longi; petioluli laterales ca. 1 mm. longi; foliola lateralia 2,8×1,3—5×2,3 cm. longa et lata, foliola terminalia 4,1×1,8—6×2,8 cm. longa et lata. Inflorescentiae axis primarius ca. 0,4 cm. longus; pedicelli 1—1,2 cm. longi. Calyx ca. 0,6 cm. longus, lobis ad 0,2 cm. longis. Fructus ca. 13 cm. longus; gynophorus ca. 1,7 cm. longus; segmenta ca. 1,8×0,8 cm. longa et lata; stylus persistens, ca. 1 cm. longus.

Hab. — Nova-Caledonia (Deplanche anno 1861-67, n. 327) in Hb. New-York et Kew.

Obs. — Cette espèce ressemble beaucoup à l'*A. sericeus*, à cause de ses feuilles épaisses, de ses pétioles très courts et de ses branches dont le feuillage est très dense. Mais la forme de ses inflorescences est si différente, que nous avons pensé bien faire en lui donnant une place systématique, éloignée de l'*A. sericeus*.

Maintenant nous allons reproduire la description de Baillon pour l'*A. sanguineus*, et nous intercalerons entre parenthèses les caractères spécifiques qui ont été mentionnés, à tort selon nous, dans la diagnose générique.

7. **Arthroclianthus sanguineus**, Baillon in *Adansonia* IX, 297 (Avril 1870). — « Frutex 3—6 metralis ; ramis diffusis « lignosis, glabris, uti folia glabris. Folia rigidula ; foliolis forma « variis, aut subellipticis, aut elliptico-lanceolatis, basi saepius « angustatis, apice rotundatis v. ad apicem angustatis acuminatisve ; summo apice obtusato ; (foliolis petiolulatis) petiolulis « basi articulatis. — Racemi recti (rachi rigidula recta) rachi quam « folium breviore ; bracteis (brevibus distichis), junioribus arcte « imbricatis ; (floribus longe pedicellatis), pedicellis filiformibus, « rachi aequalibus v. longioribus. Flores « sanguinei » speciosi « ad 4 cm. longi, calycis lobi obtusi ; (vexillum subovatum, apice « plerumque acutatum, breviter unguiculatum, reflexum ; alae « longius unguiculatae falcatae, acutae vel acuminatae, carinae « longiori adhaerentes). Legumen valde elongatum, ad 20 cm. « longum et 2/3 cm. latum, glabrum (legumen longe stipitatum) « articulis glabris, submembranaceis, utrinque angustatis.

« Hab. — In Austro-Caledoniae ins. Pinorum, inde olim accepit « C. F. Muell. Melbournensis. Stirpem quoque memini me olim « vidisse inter exsicc. claror. Vieillard et Pancher in Hb. Mus. « colon. gallic. »

Cette description est la reproduction exacte et *in-extenso* de Baillon. Nous la donnons comme telle, vu la rareté de l'ouvrage où elle fut publiée pour la première fois.

Imprimerie Reggiani & Renaud, Genève.

CONTRIBUTIONS FROM THE NEW YORK BOTANICAL
GARDEN—No. 131

STUDIES ON THE ROCKY MOUNTAIN FLORA—XXI

BY PER AXEL RYDBERG

NEW YORK
1910

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL CLUB 37:
127–148. 31 Mr 1910

[From the Bulletin of the Torrey Botanical Club, 37: 127–148. 1910]

Studies on the Rocky Mountain flora — XXI

Per Axel Rydberg

Ambrosia media sp. nov.

Annual; stem 4–6 dm. high, hispid with ascending or appressed short hairs, more or less strigose, branched; leaves pinnately divided, thick, 5–10 cm. long, scabrous and glandular-granuliferous above, hispid-strigulose beneath, all except the uppermost with shorter or longer, hirsute-ciliate, narrowly winged petioles; divisions oblong or lanceolate, usually more or less cleft or toothed, the lobes or teeth lanceolate, acute; staminate racemes rather dense; involucre nodding, slightly lobed with 5 rounded lobes and crenulate, 4–5 mm. in diameter, hispid-strigose; hairs about 0.5 mm. long, with more or less pustulate bases; receptacle with few narrow lance-subulate scales; fruit obovoid; body about 3 mm. long, puberulent or in age glabrate, with 5–7 sharp spines 0.5 mm. long and strongly directed forward; beak about 1 mm. long, pubescent.

In the form and texture of the foliage, this species resembles *A. coronopifolia* T. & G. (*A. psilostachya* of most authors) as closely as to make it almost impossible to distinguish the two by the leaves alone, the only difference being that the leaves of *A. media* are more inclined to be petioled and the petioles distinctly hispid-ciliate. Otherwise, the plant is more closely related to *A. elatior* and *A. artemisiifolia*, the root being annual and the fruit spiny. *A. coronopifolia* has a larger fruit, which is inclined to be round-elliptic instead of obovoid, is more pubescent, without spines, either perfectly smooth or rarely with small rounded tubercles.

Colorado: Fort Collins, Aug. 27, 1885, *C. S. Crandall* (type, in herb. N. Y. Bot. Gard.).

New Mexico: Pecos, San Miguel County, Aug. 20, 1898, *Standley 5138*; Kingston, 1904, *Metcalfe 1337* (?).

Coahuila: Saltillo 1898, *Palmer 293*.

Montana: Sand Coulee, Sept. 7, 1885, *R. S. Williams*.

Nebraska: Chadron, Oct. 9, 1897, *J. M. Bates 706* (plants predominantly pistillate).

Grindelia integerrima sp. nov.

Perennial, with a cespitose base; stems about 3 dm. high, glabrous, somewhat angled by the decurrent lines; leaves narrowly oblanceolate, 2–4 cm. long, acute, strongly resinous-dotted, entire; heads numerous, corymbose; involucre about 7 mm. high and 1 cm. wide; bracts lanceolate, with very short, terete, squarrose tips; ligules 6–7 mm. long; pappus-bristles slightly flattened, curved and twisted, 3 mm. long, about the length of the achenes.

This somewhat resembles *Grindelia nana* in general habit but differs in the broader bracts with much shorter tips and the strongly curved and twisted pappus-bristles.

IDAHO: Sandy soil near Granite Station, Kootenai County, July 29, 1892, *Sandberg, MacDougal, & Heller 784* (type, in herb. N. Y. Bot. Gard.).

Grindelia columbiana (Piper) Rydb. comb. nov.

Grindelia discoidea Nutt. Trans. Am. Phil. Soc. **7**: 315. 1840. Not *G. discoidea* H. & A. 1836.

Grindelia nana discoidea A. Gray, Syn. Fl. **1**²: 119. 1884.

Grindelia nana columbiana Piper, Contr. U. S. Nat. Herb. **11**: 556. 1906.

Chrysopsis angustifolia sp. nov.

Chrysopsis stenophylla Britt. & Brown, Ill. Fl. **3**: 327. 1898. Not *C. stenophylla* (A. Gray) Greene. 1884.

Perennial, with a cespitose caudex; stems erect, 2–4 dm. high, canescent and more or less hirsute; leaves narrowly linear-oblanceolate, the lower short-petioled, the upper sessile, 2–5 cm. long, 2–5 mm. wide, acute, grayish-strigose on both sides, somewhat hispid-ciliate on the lower portion; involucres turbinate-campanulate, 8–10 mm. high and about as broad; bracts narrow and linear, acute, grayish-strigose; rays about 1 cm. long; achenes canescent; outer pappus of short bristles; inner pappus-bristles tawny.

This is intermediate between *Chrysopsis foliosa* and *C. stenophylla*. It resembles the latter in leaf-form but differs in being more canescent, less hispid, not at all viscid, and in the bracts, which are narrower, and strigose-canescent instead of hispid and viscid-puberulent. From *C. foliosa* it differs in the narrower, spreading leaves, the more distinctly peduncled heads, and less white pubescence.

NEBRASKA: Middle Loup River, near Mullen, Hooker County, Sept. 14, 1893, *P. A. Rydberg 1766* (type, in herb. N. Y. Bot. Gard. and Columbia Univ.); Long Pine, Sept. 14, 1890, *J. M. Bates;* Deuel County, Aug. 24, 1891, *Rydberg 149.*

KANSAS: Kiowa County, Sept. 4, 1898, *L. F. Ward.*

ALBERTA: Vicinity of Banff, Aug. 14, 1899, *McCalla 2032*, in part.

Chrysopsis Butleri sp. nov.

Perennial; stem decumbent at the base or erect, grayish-hispidulous and slightly hirsute; leaves 1–3 cm. long, the lower obovate, the upper oblong or elliptic, obtuse or apiculate, often spreading, sessile, grayish-hirsute with short hairs; heads peduncled but usually subtended by an oblong small leaf; involucres 8 mm. high, 10–15 mm. broad; bracts linear, acute, hirsutulous, but not at all glandular or viscid; ligules about 8 mm. long; achenes silky-strigose; pappus tawny, the outer of minute bristles.

This species is characterized by the small, obovate or elliptic, subsessile leaves, which are often spreading and with short spreading pubescence. Nearly all the species of the *Chrysopsis villosa* group, with spreading pubescence, are more or less viscid or glandular, but this is not at all the case with *C. Butleri.* In leaf-form it resembles *C. villosa*, but both leaves and heads are smaller and the pubescence is different. In *C. villosa* the hairs are at least in the young state appressed.

MONTANA: Gateway, Aug. 17, 1908, *B. T. Butler 620* (type, in herb. N. Y. Bot. Gard.); Midvale, Sept. 3, 1901, *Umbach 564;* Wild Horse Island, Aug. 13, 1908, *Butler 480, 481, 485, 491.*

WYOMING: Near Fort Laramie, 1842, *Fremont 482.*

UTAH: City Creek Cañon, 1875, *M. E. Jones;* same locality, Oct. 7, 1905, *Garrett 1703.*

Chrysopsis grandis sp. nov.

Perennial, with a cespitose caudex; stems about 3 dm. high, leafy, long-hirsute, hispidulous and resinous-granuliferous; leaves spatulate or oblanceolate, 3–5 cm. long, the lower petioled, the upper sessile, hirsute or hispid and conspicuously resinous-granuliferous, apiculate; heads corymbose, short-peduncled, rarely subtended by a small leaf; involucres 8 mm. high, 12–18 mm. broad; bracts densely hirsute, only slightly granuliferous; rays golden yellow, about 1 cm. long; achenes strigose; pappus yellowish tawny, the outer of short bristles.

This species is related to *Chrysopsis hispida* and *C. columbiana*, but differs from both in the larger heads; it differs also from the former in the more copious pubescence and the more decidedly oblanceolate and petioled leaves; from the latter in the longer pubescence, the more copious resinous granules and the more decidedly petioled leaves.

MONTANA: Jocko Creek, June 16, 1901, *MacDougal 275* (type, in herb. N. Y. Bot. Gard.); also *265*.

Chrysopsis barbata sp. nov.

Perennial; stems about 3 dm. high, more or less tinged with purplish or red, hirsute with long white hairs and somewhat puberulent; leaves sessile, lanceolate, 3–5 cm. long, the upper acuminate, long-hirsute and somewhat resinous-granuliferous; heads subsessile; involucres 1 cm. high and 12–15 mm. broad; bracts linear, acute, sparingly long-hirsute and resinous-granuliferous; ligules about 7 mm. long, golden yellow; achenes strigose; pappus brownish tawny, the outer squamulate, 1–1.5 mm. long.

This species is related to *Chrysopsis hispida* but differs in the long, dense pubescence, a much less abundance of resinous granules, larger leaves and heads, and more conspicuous outer pappus. It grows on sandy plains.

IDAHO: Valley of Spokane River, Kootenai County, July 17, 1893, *Sandberg, MacDougal, & Heller 664* (type, in herb. N. Y. Bot. Gard.).

Chrysothamnus attenuatus (Jones) Rydb. sp. nov.

Bigelovia Howardi attenuata Jones, Bull. Calif. Acad. Sci. II. **5**: 691. 1895.

Chrysothamnus affinis attenuatus A. Nels. Bot. Gaz. **28**: 374. 1899.

Chrysothamnus salicifolius sp. nov.

A shrub 3–10 dm. high; branches erect, white or gray, finely pannose-tomentulose; leaves linear, 3-nerved, 4–6 cm. long, 3–6 mm. wide, minutely tomentulose; heads in a dense corymbiform cyme; involucres 7–8 mm. long; bracts elliptic, oval or ovate, the outer acutish, the inner obtuse or rounded at the apex, erose-ciliate, the outer slightly tomentose, the inner glabrous; corollas about 1 cm. long; teeth 1.5–2 mm. long, lanceolate, obtusish; achenes coarsely strigose, angled.

This species resembles *Chrysothamnus graveolens* in habit, but the leaves are broader, more tomentulose; the bracts are slightly tomentulose, erose-ciliate, and broader than in that species. Ward's specimens were determined by Dr. Gray as *Bigelovia graveolens latisquamea* and included therein in the Synoptical Flora; but it is wholly distinct therefrom. The true *C. latisquamea* (A. Gray) Greene has very white filiform-revolute leaves and the bracts more rounded at the apex.

UTAH: Strawberry Valley, Sept. 3, 1883, *F. E. Leonard 288* (type, in herb. N. Y. Bot. Gard.); Twelve-mile-Creek, Aug. 29, 1875, *L. F. Ward 659.*

Chrysothamnus stenolepis sp. nov.

Low shrub, 2–3 dm. high, somewhat spinescent; branches short, erect, glabrous or finely puberulent above; leaves narrowly lance-linear, 1–2 cm. long, 2–4 mm. wide, glabrous, scabrous-ciliate on the margins, convolute and somewhat twisted; inflorescence corymbiform, of few heads; involucres about 8 mm. long; bracts 4-ranked in 3 series, narrowly lanceolate, or the inner linear, acute, glabrous, keeled, somewhat viscid; corollas scarcely exceeding the involucre; lobes lanceolate, 2 mm. long; achenes hirsute-strigose.

This species is related to *Chrysothamnus viscidiflorus* and *C. glaucus*, but differs from both in the very narrow acute bracts.

MONTANA: Pass Creek, near Bridger Pass, *H. Engelmann* (type, in herb. Columbia Univ.).

UTAH: Saleratus River, Aug. 1889, *C. K. Dodge.*

Chrysothamnus marianus sp. nov.

Undershrub, 1–2 dm. high, with a woody thick caudex; branches erect, at first green, soon straw-colored or white, densely and finely puberulent; leaves linear or the lower linear-oblanceolate, acute, thick, densely puberulent, 1–2 cm. long, 1–15 mm. wide, 1-nerved, somewhat twisted; heads narrow, in small, corymbiform-cymose panicles, involucres about 5 mm. high; bracts yellowish, glutinous, erose-ciliate on the margins, 4-ranked and in about 3 series, the outer ovate, acutish, the inner spatulate-oblong, rounded at the apex; achenes sparingly strigose; corollas scarcely exceeding the involucres.

This species has many characters of *Chrysothamnus puberulus*, but differs in the more yellowish-green herbage, the whiter stems, the narrower, more erect, thick, 1-nerved instead of 3-nerved leaves, the finer pubescence, and the involucres, which are narrower and with different bracts. In *C. puberulus* the inner bracts are linear or linear-lanceolate and acute. The young achenes are only slightly strigose, in which respect it approaches *C. Bakeri* and *C. Vaseyi.*

UTAH: Along Sevier River, below Marysvale, July 20, 1905, *Rydberg & Carlton 6993* (type, in herb. N. Y. Bot. Gard.); also *6983;* Mount Barette, July 26, *7253.*

SOLIDAGO MISSOURIENSIS Nutt. Jour. Acad. Phila. 7: 32. 1834

Solidago Tolmieana A. Gray, Syn. Fl. 1^1: 151. 1884.

Dr. Gray in the original publication of *S. Tolmieana* adds the following note: "Has been taken for a form of *S. missouriensis* var. *montana;*" but he overlooked the fact that it was identical with the original *S. missouriensis.* He might have been led astray by Nuttall himself, who later included in *S. missouriensis* the common plant of the upper Missouri Basin with recurved secund branches. That the latter is not the original *S. missouriensis* may be seen from Nuttall's diagnosis, of which I here give a copy:

"55 SOLIDAGO * *missouriensis.* Pumila, glabra, racemis erectis, foliis lineari-lanceolatis, acutis, inciso-subserrulatis, superioribus integris, panicula brevi laxa, floribus majusculis."

"Stem slender, smooth, leafy, about a foot or so high. Leaves scabrous at the margin. Panicle about three inches long, the branches slender, the flowers pedicellate, and brought together in a somewhat rhomboidal raceme. Rays as long as the calyx."

This agrees with *S. Tolmieana* but not with the plant described by Gray as *S. missouriensis.*

The original *Solidago missouriensis* was collected by Wyeth on the upper branches of the Missouri. There is a specimen of this collection in the Torrey Herbarium which agrees with the description and this matches very well the type of *S. Tolmieana* in the Gray Herbarium. The plant described by Gray as *S. missouriensis* is characterized by its flat-topped or round-topped inflorescence with recurved-spreading, secund branches, in variance with Nuttall's characterization: "racemis *erectis,*" and "the flowers pedicellate, and *brought together* in a somewhat rhomboidal *raceme*." The synonymy of Gray's plant is as follows:

SOLIDAGO GLABERRIMA Martens, Bull. Acad.
Brux. 8: 68. 1841

Solidago missouriensis Nutt. Trans. Am. Phil. Soc. II. **7**: 327, in part. 1840. Not *S. missouriensis* Nutt. 1834.
Solidago missouriensis A. Gray, Syn. Fl. **1**^{2}: 155. 1884.
Solidago serotina Hook. Comp. Bot. Mag. **1**: 97. 1835. Not *S. serotina* Ait. 1789.

Solidago glaucophylla sp. nov.

Perennial, with a branching rootstock; stems slender, pale, glabrous up to the sparingly pubescent inflorescence; leaves glabrous, glaucous, minutely ciliolate on the margins, rather thick, linear-oblanceolate or the upper linear, triple-nerved, 6–10 cm. long, 4–10 mm. wide, entire, acute; inflorescence a round-topped panicle, the branches somewhat recurved-spreading and somewhat secund; heads about 5 mm. high; bracts oblong, obtuse, or the outer lance-oblong, acutish; rays short, 2–2.5 mm. long, 0.7–0.8 mm. wide; achenes slightly strigose-hirsute.

This species is related to *Solidago missouriensis* and *S. glaberrima*, but differs from both in the narrow, entire, glaucous leaves and the thicker, oblong and obtuse instead of linear-lanceolate and acute bracts. The type grew on dry plains at an altitude of 1000 m.

MONTANA: Dry plains near Kalispel, Flathead Valley, July 25, 1901, *MacDougal 760* (type, in herb. N. Y. Bot. Gard.).

WYOMING: Buffalo, July 25, 1896, *A. Nelson 2501* (?, similar but with narrower inflorescence).

Solidago nivea sp. nov.

Perennial, with a woody cespitose rootstock and short caudex; stems 1–2 dm. high, decumbent at the base, canescent-puberulent; basal leaves 2–4 cm. long, short-petioled; blades obovate-spatulate, rounded at the apex, entire or nearly so; stem-leaves oblanceolate, sessile, the upper acutish; all leaves thick, densely canescent-puberulent, almost velvety and almost white; inflorescence a flat-topped corymbiform panicle; heads slightly nodding at first, but not secund on the branches, about 6 mm. high;

bracts yellowish with a greenish midrib, lanceolate and acute; achenes hirsute-strigose; ligules 3 mm. long and nearly 1 mm. wide.

This is closely related to *Solidago nana*, but differs in the narrower, lanceolate, and acute bracts. Its pubescence is usually also denser and whiter. Platt's specimens were labeled *S. missouriensis* v. *montana* Gray, to which it has no relationship, only resembling it a little in habit and in the narrow bracts.

MONTANA: Lima, Aug., 1905, *Rydberg 2804* (type, in herb. N. Y. Bot. Gard.); Hot Sulphur Springs, July 24, 1871, *W. B. Platt.*

Solidago Garrettii sp. nov.

Perennial, with a creeping rootstock; stem 2–3 dm. high, sparingly puberulent or glabrous; leaves obovate-spatulate or the upper oval, entire or the lower toothed towards the apex, rather thin, triple-nerved, minutely and sparingly scabrous-puberulent or nearly glabrate, scabrous-ciliolate on the margins, 3–6 cm. long; inflorescence more or less leafy, with a few secund branches; heads 5–6 mm. high; bracts lanceolate, acute, yellowish; ligules 2 mm. long and fully 0.5 mm. wide, golden yellow; achenes sparingly hirsute.

This species is related to *Solidago mollis*, *S. radulina*, and *S. Radula*. It differs from the first in the thinner, green, more decidedly obovate, and sparingly pubescent leaves, and the open, few-branched panicle; from *S. radulina* in the larger, thinner leaves, the open and more leafy inflorescence, and the acute instead of obtuse bracts; and from *S. Radula* in the thin, broad leaves, large, ample upper stem-leaves, the small inflorescence, and acute bracts.

UTAH: Big Cottonwood Cañon, Aug. 28, 1906, *A. O. Garrett 2041* (type, in herb. N. Y. Bot. Gard.); same locality and collector, Aug. 14, 1905, *1608*, and Aug. 5, 1905, *1587*.

WYOMING: Headwaters of Cliff Creek, Aug. 9–18, 1900, *C. C. Curtis.*

ASTER RICHARDSONII Sprengel, Syst. **3**: 528. 1826

Aster montanus Richards. App. Frankl. Journ. 749. 1823. Not *A. montanus* Nuttall. 1818.

Aster salsuginosus Less. Linnaea **6**: 124. 1831. Not *A. salsuginosus* Richards. 1823.

Aster Richardsonii, var. *gigantea* Hook. Fl. Bor.-Am. **2**: 7. 1834.
Aster sibiricus giganteus A. Gray, Syn. Fl. 1^2: 177. 1884.
Aster giganteus Rydb. Bull. N. Y. Bot. Gard. **2**: 184. 1901.

In describing *Aster meritus*,* Professor Aven Nelson evidently was correct in referring the name *A. Richardsonii* Spreng. to the subarctic species, characterized by the densely villous peduncles and involucres, which the writer has named *A. giganteus*. Richardson collected both, as shown by specimens in the Columbia University herbarium, and evidently included both under the name *A. montanus*, but his description applies only to the plant which Hooker afterwards named and described as *A. Richardsonii*, var. *gigantea*. There are, however, two points in Professor Nelson's discussion which are a little erroneous, ambiguous, and unclear, wherefore I add the following.

Professor Nelson has made the following remarks: "It is equally clear that *A. Richardsonii* is the name given to the *A. montanus* Nutt." If this was true, *A. Richardsonii* should be a synonym of *A. sericeus montanus* of the Southern States, and I received that impression when I read Professor Nelson's discussion. Evidently this was not Professor Nelson's intention. He evidently meant *A. montanus* Richardson.

From Professor Nelson's discussion, one also gets the impression that *A. meritus* Nels. is not found in the subarctic regions, and is a plant of the Rocky Mountains only, but this is not the fact. The specimens regarded as *A. Richardsonii* by Hooker and cited in his Flora, as collected in the "barren country from lat. 64° to the Arctic Seas" belong to *A. meritus*. Two of Richardson's specimens are in the herbarium of Columbia University. These cannot be distinguished from Nelson's *nos. 2334* and *6610* cited under *A. meritus*.

As said before, Richardson collected both plants. Hooker was the first one to distinguish them and made one the species, the other the variety of *A. Richardsonii* Spreng., as *A. montanus* Richardson was not available on account of the older *A. montanus* Nutt., *A. Richardsonii* Spreng. being only a substitute for the former. Under ordinary circumstances, we should have followed Hooker's interpretation and used *A. Richardsonii* for the short-pubescent plant. The writer made such a ruling in 1901, when he raised *A. Richardsonii*, var. *gigantea* to specific rank. But it is evident from Richardson's description that his *A. montanus* characterized rather the more villous-tomentose plant. Not only was Sprengel's *A. Richardsonii* based upon *A. montanus* Richardson, but his description also characterizes Hooker's var. *gigantea*.

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* Bot. Gaz. **37**: 268. 1904.

The synonymy of the more southern plant is as follows:

ASTER MERITUS A. Nelson, Bot. Gaz. **37**: 269. 1904

Aster montanus Richardson, App. Frankl. Journ. 32, in part (?). 1823.

Aster Richardsonii Hook. Fl. Bor.-Am. **2**: 7. 1834. Not *A. Richardsonii* Spreng. 1826.

Aster sibiricus A. Gray, Syn. Fl. **1**^{2}: 176. 1884. Not *A. sibiricus* L. 1753.

Aster Williamsii sp. nov.

Perennial, with cespitose rootstock; stems erect, about 3 dm. high, more or less villous; leaves oblanceolate, 3–10 cm. long, the lower petioled, the upper sessile, finely villous on both sides; heads few in a corymbiform inflorescence; involucres 8 mm. high, 1 cm. broad; bracts linear or lance-linear, acute, sparingly and finely villous on the back, slightly scarious-margined below, imbricate in 3 series; rays lilac, about 1 cm. long; achenes sparingly and finely pilose; pappus tawny.

This species is somewhat intermediate between *Aster andinus* and *A. meritus*. From the former it differs in the taller and more slender, erect stem, the finely villous leaves, the shorter, more numerous and more pubescent involucral bracts; and from the latter in the narrower leaves, which are always entire, in the comparatively higher involucre, and the narrower bracts.

WYOMING: Dry hills, North Fork of Clear Creek, Big Horn Mountains, Aug. 12, 1898, *T. A. Williams* (type, in herb. N. Y. Bot. Gard.); eastern slope of Big Horn Mountains, headwaters of Clear Creek and Crazy Woman River, July 20–Aug. 15, 1900, *Tweedy 3096A*.

Aster Macounii sp. nov.

Perennial, with a rootstock; stem 3–6 dm. high, sparingly hispid-strigose, purple-tinged; leaves thick, oblanceolate or lanceolate, 2–8 cm. long, hispidulous-ciliate, otherwise glabrous; inflorescence corymbiform ; heads solitary on branches with lanceolate bract-like leaves ; involucre 8–10 mm. high, 12–15 mm. broad ; bracts oblanceolate, squarrose, acute and spinulose-tipped, pubescent on the back and ciliate on the margins ; rays 7–8 mm. long, rose-colored ; achenes strigose, pappus pinkish tawny.

This species combines the characters of two different groups of asters. It has the habit, leaves, middle-sized heads, pappus, and pubescence of the bracts of *Aster Nelsonii*, *A. griseus*, and their allies, but has the spinulose- or callus-tipped bracts and upper leaves of *A. multiflorus*, *A commutatus*, etc.

CANADA : Old Wives Lake, Northwest Territory [Keewatin], July, 1880, *John Macoun* (type, in herb. Columbia Univ.).

ASTER LINDLEYANUS T. & G. Fl. N. Am. **2** : 122. 1841

Aster paniculatus, var. δ Lindl. in Hook. Fl. Bor.-Am. **2** : 8. 1834.

Dr. Gray in his Synoptical Flora* stated : "The original of this species was raised by Gordon from Labrador seeds and has more extended inflorescence of smaller heads than is common in the wild plant." Dr. Gray evidently referred to *Aster paniculatus* Ait. ;† however, *A. Lindleyanus* was not based on *A. paniculatus* Ait., but principally on *A. paniculatus*, var. δ of Lindley in Hooker's Flora, although *A. paniculatus* of the same work was partly included. The var. δ was collected by Richardson near Slave Lake. Whether this plant is the same as *A. paniculatus* Ait. is very doubtful. *Aster Lindleyanus* has been reported from many stations in eastern North America as far south as Ohio, but the eastern plant differs somewhat from that of the Mackenzie basin and the northern Rockies in thinner more decidedly cordate basal leaves, and in its bracts with more conspicuous green tips. As these differences are hardly specific it is best to leave the eastern plant in *A. Lindleyanus*. In the northern Rockies and the Saskatchewan region there are found plants which have been referred to *A. Lindleyanus* but which the writer thinks are distinct. They can be distinguished as follows :

Basal leaf-blades cordate or broadly ovate ; upper stem-leaves lanceolate ; achenes glabrous.
  Petioles, midribs, and usually also the stem pubescent with long white hairs.. *A. Wilsonii.*

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* 1^2 : 182. 1884.

† Hort. Kew. 3 : 207. 1789.

Plant glabrous or sparingly short-pubescent.......................... *A. Lindleyanus.*
Basal leaf-blades lanceolate; upper stem-leaves narrowly lanceolate or those of the inflorescence lance-linear.
Heads few; involucres 8–9 mm. high; rays about 15 mm. long; achenes glabrous.. *A. MacCallae.*
Heads numerous; involucres 5–6 mm. high; rays 8–10 mm. long; achenes hispidulous-strigose.................................. *A. Butleri.*

Aster Wilsonii sp. nov.

Aster Lindleyanus β T. & G. Fl. N. Am. **2**: 122. 1841.

Perennial, with a horizontal rootstock; stem 3–6 dm. high often purplish, more or less pubescent with long white, curved, somewhat deciduous hairs; basal leaves petioled; petioles 5–10 cm. long, densely white-ciliate, together with the midrib; blades ovate or subcordate, 5–10 cm. long, usually more or less hirsute on both sides, but in age glabrate, serrate, acuminate at the apex; the lower stem-leaves similar; the upper lanceolate, sessile, subentire or those of the paniculate inflorescence narrowly lanceolate; involucre 7–8 mm. high, scarcely 1 cm. wide; bracts subulate, attenuate, with a green midrib which widens somewhat above the middle; rays 8–10 mm. long, bluish purple; pappus tawny; achenes glabrous.

This species is related to *Aster Lindleyanus* and may grade into it, but the typical specimens are very distinct, characterized by the long white hairs on the petioles, midribs, and often the stem, by the narrower upper leaves, the smaller heads, and the more ascending branches.

BRITISH COLUMBIA: Armstrong, 1904, *E. Wilson 419* (type, in herb. N. Y. Bot. Gard.); also *414*, *416*, and *393*.

ALBERTA: Grattan Creek, Aug. 16, 1906, *Macoun & Herriot 77073;* also Edmonton, Aug. 26, 1906, *77074*.

WESTERN ONTARIO: Fort Williams, Sept. 7, 1889, *Dr. and Mrs. N. L. Britton and Miss Millie Timmerman.*

MACKENZIE: Fort Resolution and Mackenzie River, 1861–2, *R. Kennicott.*

Aster MacCallae sp. nov.

(?) *Aster praecox* Lindl. in Hook. Fl. Bor.-Am. **2**: 9. 1834. Not *A. praecox* Willd. 1813.

Perennial, with a horizontal rootstock; stems 3–6 dm. high, often purplish, glabrous up to the inflorescence, the branches of which are slightly pubescent in lines; lower leaves with winged petioles, which are slightly dilated and ciliate at the base; blades broadly lanceolate, 8–15 cm. long, usually more or less serrate with ascending teeth, acute, glabrous or essentially so, hispidulous-ciliolate on the margins, rather thick; upper leaves lanceolate, sessile or those of the inflorescence lance-linear; inflorescence or its few principal branches racemiform; involucres 8–9 mm. high, 1 cm. broad; bracts subulate, glabrous, with linear-lanceolate green tips and green midveins below; rays blue or bluish purple, about 15 mm. long; disk-flowers red-purple; achenes glabrous, at least in age.

This may be the *A. praecox* of Hooker's Flora Boreali-Americana; but the name is preoccupied by *A. praecox* Willd. It is related to *A. Lindleyanus*, but differs in the narrower leaves, of which the lower are neither cordate nor broadly ovate and those of the inflorescence are lance-linear, in the larger rays, which are about 15 mm. long, and in the more ascending branches of the simpler inflorescence.

Alberta: Along streams, edge of woods on the Sulphur Mountain, Aug. 16, 1899, *McCalla 2026* (type, in herb. N. Y. Bot. Gard.); roadside, Spray Avenue, Banff, Sept. 18, 1899, *McCalla 2027*; below Wapta Lake, Aug. 6, 1904, *J. Macoun 69480*; gravelly banks, Second Lake, Rocky Mountain Park, Aug. 3, 1891, *Macoun 7770*.

Aster Butleri sp. nov.

Perennial, with a horizontal rootstock; stem 4–10 dm. high, glabrous, slender; lower leaves petioled; blades lanceolate, about 1 dm. long, distantly serrate with ascending teeth, hispidulous-ciliolate on the margins, otherwise glabrous; upper stem-leaves sessile, narrowly lanceolate, or those of the inflorescence lance-linear, entire; inflorescence paniculate with numerous heads; involucres 5–6 mm. high. about 8 mm. wide; bracts subulate, with green midribs and narrowly lanceolate green tips, attenuate, glabrous; rays bluish purple, 8–10 mm. long; achenes hispidulous-strigose.

This is related to the preceding, but differs from it in the large inflorescence with numerous small heads, and in the pubescent achenes. In the latter respect it differs from all the species of the *Aster Lindleyanus* group.

Montana: Gateway, Aug. 16, 1908, *B. T. Butler 443* (type, in herb. N. Y. Bot. Gard.); also *433*.

ALBERTA: Field, Aug. 28, 1904, *J. Macoun 65485*.

BRITISH COLUMBIA: Flood plains of Columbia at Beavermouth, Aug. 18, 1905, *C. H. Shaw 1165*; Armstrong, 1904, *E. Wilson 422* (?); Emerald Lake, Aug. 30, 1904, *J. Macoun 65488* (in part).

Aster subsalignus sp. nov.

Perennial, with a rootstock; stem glabrous throughout, 6–10 dm. high; leaves nearly erect, glabrous, glaucous, entire, clasping but scarcely auricled, 5–10 cm. long, narrowly linear, 6–7 mm. wide, or the lower narrowly linear-oblanceolate, or those of the branches lance-linear and reduced; inflorescence paniculate; involucres about 7 mm. high and 8 mm. wide; bracts linear or the outer linear-lanceolate, glabrous, acute, with a green midrib and narrowly lanceolate green tip, or the outer nearly wholly green; rays bluish or bluish purple, about 8 mm. long; achenes glabrous; pappus tawny; disk-flowers dark, red-purple.

This is related to *Aster Geyeri*, but differs in the narrow leaves, scarcely auricled at the base; they are also more erect or strongly ascending and wholly entire. It stands in the same relation to *Aster Geyeri* as *A. virgatus* and *A. concinnus* do to *A. laevis*. It has the narrow green tips of the bracts found in *A. Geyeri* but not in the others. The spreading branches of the inflorescence with their very small bract-like leaves characteristic of the three are not found in this species, and scarcely in *A. Geyeri*.

COLORADO: Glenwood Springs, Aug. 18, 1906, *G. E. Osterhout 3397* (type, in herb. N. Y. Bot. Gard.).

ASTER WOOTONII Greene, Leaflets **1**: 146. 1905.

Aster hesperius Wootonii Greene, Bull. Torrey Club **25**: 119. 1898.

In raising the variety to specific rank, Dr. Greene stated: "Mr. Baker's n. 817 from near Gunnison represents well that of Mr. Wooton's distribution from New Mexico, and I judge the form worthy of specific rank." In the herbarium of the New York Botanical Garden there are duplicates of both *Baker 817* and *Wooton 329*, the latter the type of *A. hesperius Wootonii*. The two are not the same. The latter has the subequal loose bracts and entire leaves of *A. hesperius*, and is best referred to that species; in fact it matches very closely *Wright 1158*, which number I take to be the type of *A. hesperius*. In the former the bracts are well imbricated in 3 or 4 unequal series and the leaves are distinctly dentate and it agrees in every respect with specimens of *A. paniculatus*. In the writer's judgment it is nothing but the not uncommon pinkish- or light lilac-flowered form of that species.

Aster roseolus sp. nov.

Perennial, with a horizontal rootstock; stem 3–5 dm. high, often purple-tinged, glabrous, pilose in lines on the branches; leaves linear, glabrous or nearly so, scabrous-ciliolate on the margins, 5–10 cm. long, 5–12 mm. wide, inflorescence paniculate but the heads usually few; involucres about 5 mm. high, 8–9 mm. broad; bracts glabrous, oblong or oblong-linear, acute, in about 3 series, often wholly green, with broadly lanceolate tips; rays rose-colored, 5–6 mm. long; achenes hispidulous-strigose.

This species is related to *Aster longulus* and *A. Tradescanti*, but differs in the bright rose-colored rays, the less numerous heads, simpler plant, and broader leaves. It grows in meadows at an altitude of 1500–2000 m.

MONTANA: Melrose, 1895, *Rydberg 2817* (type, in herb. N. Y. Bot. Gard.); Lima, Aug. 5, 1895, *Rydberg;* Logan, July 28, 1895, *Shear 5253;* Emigrant Gulch, Aug. 23, 1897, *Rydberg & Bessey 5121.*

Aster Franklinianus Rydb. nom. nov.

Aster salicifolius Richardson, in Frankl. Journ. 748. 1823. Not *Aster salicifolius* Lam. 1783.

Aster laxiflorus Lindl. in Hook. Fl. Bor.-Am. **2**: 10, mainly. 1834. Not *Aster laxiflorus* Nees. 1833.

Aster laxiflorus borealis T. & G. Fl. N. Am. **2**: 138, in part. 1841.

Dr. Gray referred this to *Aster junceus* but it is more closely related to *A. longifolius*, having the subequal bracts and the dark green leaves of that species, but the bracts are narrower and strictly appressed and the leaves are very narrowly linear and as far as I know perfectly entire. It is *A. laxiflorus* of Lindley mainly but he included a specimen of Mrs. Percival's from eastern Canada (apparently of *A. junceus*), and this very specimen is the type of *A. laxiflorus borealis* T. & G. Otherwise the species would have become *A. borealis* Prov., as Provancher raised the variety to specific rank. He also characterized the eastern plant. The following specimens belong to *A. Franklinianus:*

MACKENZIE TERR.: Slave Lake, *Richardson;* Wooded Country, *Richardson;* Mackenzie River 1861–2, *Kennicott;* Fort Resolution, 1861–2, *Onion, Kennicott & Hardisty.*

SASKATCHEWAN: 1857–8, *E. Bourgeau.*

MONTANA: Gateway, Aug. 17, 1908, *Butler 477, 473,* and *434;* Helena, Aug. 16, 1892, *Kelsey.*

Aster junciformis sp. nov.

Aster junceus Coulter, Man. 161, in part. 1885.

Aster longulus Rydb. Fl. Colo. 356. 1906. Not *Aster longulus* Sheldon. 1894.

Perennial, with a slender horizontal rootstock; stem slender, 3–5 dm. high, simple below, with pilose lines or wholly glabrous below; leaves narrowly linear, 4–8 cm. long, 2–4 mm. wide, scabrous-ciliolate on the margins, light green; inflorescence corymbiform, with the rather few heads terminating the stem and leafy branches; involucres about 6 mm. high, about 1 cm. broad; bracts glabrous, erose-ciliolate; the inner bracts linear, acute, with green midrib and green lanceolate tips, the outer oblong or somewhat oblanceolate, obtuse, and often almost wholly green; rays white, 6–8 mm. long; achenes sparingly hairy or nearly glabrous.

This has been known under the name of *A. junceus* in nearly all western botany, but differs in the always white rays, the subcorymbose inflorescence, and the broader bracts. In the eastern *A. junceus* the bracts are narrowly linear or linear-subulate and the rays are always described as light purple.

MONTANA: East Gallatin Swamps, July 24, 1896, *Flodman 833* (type, in herb. N. Y. Bot. Gard.).

NORTH DAKOTA: Butte, Aug. 5, 1906, *Lunell.*

SOUTH DAKOTA: Custer, Aug. 15, 1892, *Rydberg 775.*

COLORADO: West Cliff, 1896, *Shear 3463, 3817;* Twin Lakes, *Clements 388* and *379.*

MINNESOTA: Minneapolis, 1891, *G. B. Aiton;* Hennepin County, 1890, *Sandberg.*

SASKATCHEWAN: Cypress Hills, 1880, *J. Macoun;* Lake Manitou, July 23, 1906, *Macoun & Herriot 77052;* also Bear Hills, July 29, *77051.*

ALBERTA: Five miles west of Battle River, 1906, *Macoun & Herriot 77053;* also Grattan Creek, Aug. 16, *77050.*

BRITISH COLUMBIA: Swamps at Gold Stream, Aug. 3, 1905, *Shaw 1081.*

Aster eriocaulis sp. nov.

Perennial, with a rootstock; stems about 8 dm. high, leafy, more or less villous, especially above, purplish; stem-leaves lanceolate, 3–7 cm. long, ciliolate on the margins, otherwise glabrous, more or less auriculate-clasping; inflorescence a round-topped panicle; involucres 8 mm. high, 10–12 mm. broad; bracts linear, acute, more or less ciliate, in 2–3 series, with green midrib and lanceolate green tips, or the outermost almost wholly green; rays purple, 8–10 mm. long; achenes sparingly hirsute-strigose.

This species is perhaps most nearly related to *Aster lonchophyllus* but differs in the longer villous pubescence of the stem, the more or less clasping leaves, less imbricated and not purple-tinged bracts. In general habit and leaf-form it resembles somewhat *A. Jessicae*, but differs in the glabrous leaves and narrower glabrous bracts.

IDAHO: Mountain meadows, valley of Traille River, Kootenai County, Aug. 9, 1892, *Sandberg, MacDougal, & Heller 877* (type, in herb. N. Y. Bot. Gard.).

Aster subcaudatus sp. nov.

Perennial, with a creeping rootstock; stem 3–6 dm. high, more or less purple, glabrous below, with villous or pilose peduncles and lines above; lower leaves petioled, 1–2 dm. long; blades lanceolate, 4–10 cm. long, often sparingly dentate with ascending sharp teeth, dark green, glabrous, ciliolate on the margins; upper leaves sessile, linear-lanceolate, attenuate; panicle open, with rather few heads; involucres 7–8 mm. high, about 12 mm. broad; bracts linear-subulate, in 2 or 3 series, but nearly of the same length, attenuate, the inner almost caudate, only slightly white-margined below; rays purple, about 1 cm. long; achenes nearly glabrous.

The type was determined as *Aster Fremontii* (?), but is evidently distinct; differing from that species as well as its relatives, *A. occidentalis*, *A. ciliomarginatus*, etc., in the narrow attenuate bracts. It is also a taller plant with a tendency to having dentate leaves. If one should use Piper's key in his Flora of Washington it would fall under *A. occidentalis* Nutt. The latter, as described in Gray's Synoptical Flora, has well-imbricated bracts, of which the outer are shorter; but neither the present species nor Gray's description agrees with the original diagnosis of *Aster occidentalis.* It may be that the plant described by Gray should receive a new name. I have not seen Nuttall's type and shall await the chance of seeing it before making such a change.

ALBERTA: Laggan, Lake Louise region, alt. 1950 m., Aug. 23, 1902, *Rosendahl 1089* (type, in herb. N. Y. Bot. Gard.); also *1061.*

IDAHO: Priest Lake, Aug. 1901, *Piper 4120, 3723, 3682.*

MONTANA: Rost Lake, July 15–16, 1901, *MacDougal 661;* Big Fork, July 24, 1908, *Butler 697.*

Aster Umbachii sp. nov.

Perennial, with a slender rootstock; stem slender, erect, simple, glabrous below, sparingly pilose above, 3–5 dm. high; lower leaves about 1 dm. long, petioled; blades broadly oblanceolate or lanceolate, dark green, more or less crenate, acute, glabrous, ciliolate on the margins; middle stem-leaves similar but the petioles with dilated, clasping bases; upper stem-leaves lanceolate, sessile; heads 1–3 in a corymbiform inflorescence; involucres 8–9 mm. high, 12–15 mm. broad; bracts in about 2 series, oblong-oblanceolate, acute, not very unlike in length, glabrous, slightly ciliate, with broad lanceolate green tips; rays dark bluish-purple, fully 1 cm. long; achenes almost glabrous; pappus tawny.

This species is most nearly related to *Aster ciliomarginatus* Rydb. (*A. glastifolius* Greene); but differs in the dark green and mostly crenate leaves and broader and more conspicuously green-tipped bracts. In *A. ciliomarginatus* the leaves are light green, more or less glaucous and entire.

MONTANA: River bank, Lake McDonald, Aug. 20, 1901, *Umbach 275* (type, in herb. N. Y. Bot. Gard.); also *267.*

Aster Mearnsii sp. nov.

Perennial, with a rootstock; stem 3–10 dm. high, leafy, branched, glabrous below, sparingly pubescent above; leaves linear, 5–10 cm. long, ascending-spreading, sessile, entire, glabrous and smooth beneath, scabrous or glabrate above, scabrous-ciliolate on the margins; inflorescence large, paniculate, leafy; heads numerous, disk about 8 mm. high and barely 1 cm. broad; bracts oblanceolate, acute, some longer than the disk; rays about 8 mm. long, white or pinkish; achenes strigulose.

This species is intermediate between *A. oreganus* Nutt. and *A. proximus* Greene. It has often been mistaken for the former, as it has the same narrow leaves and general habit, but differs in the involucre, which is essentially that of *A. proximus*, consisting of foliaceous oblanceolate outer bracts and shorter merely green-tipped inner ones; but the bracts are less squamose and the leaves much narrower, darker in color, and firmer.

WYOMING: Mammoth Hot Springs, Oct. 11, 1902, *Mearns 4806* (type, in herb. N. Y. Bot. Gard.); same locality and collector, Aug. 2, *2731* (?); Aug. 17, *3390;* Gardiner River, Sept. 11, 1902, *Mearns 3915;* Mt. Leidy, Aug., 1897, *Tweedy 561.*

MONTANA: Bozeman, Aug. 24, 1892, *Kelsey;* near Rost Lake, Aug., 1901, *MacDougal 887a;* Belt River, Oct., 1883, *F. W. Anderson 3803v.*

SASKATCHEWAN: Cypress Hills, Aug. 5, 1880, *J. Macoun 7938.*

ALBERTA: Crows Nest Pass, July 31, 1897, *J. Macoun 23076;* overflow from Middle Spring, Banff, July 16, 1899, *Sanson 2241;* Banff, Sept. 24, 1904, *J. Macoun 65486.*

Aster phyllodes sp. nov.

Aster foliaceus Britt. & Brown, Ill. Fl. 3: 371 (excluding figure). 1898. Not *A. foliaceus* Lindl. 1835.

The plant described in Britton & Brown's Illustrated Flora is not *Aster foliaceus* Lindl. of the Northwest, which is a simple plant, with 1–3 large heads and narrowly linear-lanceolate leaves. The figure in the Illustrated Flora was not drawn from my Kimball County plant as stated there. It probably does not represent an *Aster* at all. Evidently some illustrations have been interchanged. The Nebraska plant is nearer to *A. puniceus* in habit than to *A. foliaceus*, although the pubescence and bracts approach the latter. It is more closely related to *A. proximus* Greene, but differs in the more or less toothed and more distinctly auriculate, darker leaves.

The only specimens seen are the following:

NEBRASKA: Lodge Pole Creek, near Kimball, Kimball County, Aug. 12, 1891, *Rydberg 165* (type).

COLORADO: West of Livermore, Larimer Co., Aug. 26, 1896, *Osterhout 2953.*

Xylorrhiza lanceolata sp. nov.

Shrubby perennial, with white stems; branches more or less villous; leaves lanceolate, 4–6 cm. long, more or less villous, especially when young, reticulately veined, dentate with spinulose-subulate teeth, which are directed forward and then falcately curved outward; peduncles 1–2 dm. long; involucre fully 1 cm. high, 15–20 mm. broad; bracts lance-subulate, villous and slightly glandular, attenuate and spinulose-tipped, the inner about equaling the disk, a few of the outer ones often longer and squarrose; rays purple, about 2 cm. long; achenes hirsute; pappus brownish tawny.

This is related to *Xylorrhiza tortifolia* (T. & G.) Greene, but differs in the broader leaves and their teeth. In *X. tortifolia*, the body of the leaves is linear or narrowly linear-lanceolate, the teeth are shorter and broader and diverge at almost right angles to the midrib; the outer bracts are neither elongated nor spreading.

UTAH: St. George, 1877, *Palmer 208* (type, in herb. Columbia Univ. and N. Y. Bot. Gard.); South Utah, 1875, *J. E. Johnson;* 1874, *C. C. Parry 91* (?).

Unamia alba (Nutt.) Rydb. comb. nov.

Inula (*Chrysopsis*) *alba* Nutt. Gen. **2**: 152. 1818.
Aster albus Eat. Man. Bot. 127. 1829. Not *Aster albus* Willd. 1826.
Doellingeria ptarmicoides Nees, Gen. & Sp. Ast. 183. 1833.
Chrysopsis alba Nutt.; Nees, Gen. & Sp. Ast. 183, as a synonym. 1833.
Diplopappus albus Hook. Fl. Bor.-Am. **2**: 21. 1834.
Heliastrum album DC. Prod. **5**: 264. 1836.
Encephalus albus Nutt. Trans. Am. Phil. Soc. II. **7**: 299. 1840.
Aster ptarmicoides T. & G. Fl. N. Am. **2**: 160. 1841.
Unamia ptarmicoides Greene, Leaflets **1**: 6. 1903.

From the various disposition which has been made of this plant, it is evident that the species has been out of place in all the genera to which it had been referred. I therefore agree with Dr. Greene that it represents the type of a distinct genus. Unfortunately Dr. Greene did not use the first available specific name, which is here accepted. Usually the original publication is given as *Chrysopsis alba* Nutt. Gen. **2**: 152. 1818. In that work

Nuttall, however, did not publish it as *Chrysopsis* but as *Inula*, *Chrysopsis* being only a subgeneric name. The Kew Index cites DC. Prod. (*l. c.*) as the place of publication of the combination *Chrysopsis alba*, but it appeared at least one year earlier in Nees's Genera. In describing the genus *Unamia*, Dr. Greene stated: "And that the bristles of the pappus are visibly dilated at the tip is a character, here for the first time noted." This appears to be not quite the fact, for we find in the sectional description in Torrey & Gray's Flora: "the longer bristles clavellate-thickened at the apex;" and in Gray's Synoptical Flora: "pappus white, of rather rigid bristles, longer ones manifestly clavellate at tip." The expressions used by these authors are even more characteristic than Greene's description, for the pappus-bristles are by no means flattened, as the word "dilated" usually implies.

Unamia lutescens (Lindl.) Rydb. comb. nov.

Diplopappus albus β Hook. Fl. Bor.-Am **2**: 21. 1834.
Diplopappus lutescens Lindl.; DC. Prod. **5**: 278. 1834.
Aster lutescens T. & G. Fl. N. Am. **2**: 160. 1841.
Aster ptarmicoides lutescens A. Gray, Syn. Fl. $\mathbf{1}^2$: 199. 1888.

The color of the rays, yellow or ochroleucous as it has been described, is probably of little value specifically and may vary; but in the specimens seen the bracts are "very obtuse" as described in Torrey & Gray's Flora, the inner even rounded at the apex and therefore different from those of the typical *U. alba*. The range of this species seems to be more restricted than that of *U. alba*, extending from Illinois and Wisconsin to Saskatchewan.

Doellingeria pubens (Gray) Rydb. sp. nov.

Aster umbellatus pubens A. Gray, Syn. Fl. $\mathbf{1}^2$: 197. 1884.

This I think specifically distinct from *D. umbellata* (Mill.) Nees.

Machaeranthera angustifolia nom. nov.

Machaeranthera linearis Rydb. Mem. N. Y. Bot. Gard. **1**: 398. 1900. Not *M. linearis* Greene. 1897.

Machaeranthera leptophylla sp. nov.

Biennial, cespitose at the base; stems slender, simple up to the inflorescence, green, sparingly puberulent, 3–5 dm. high;

lower leaves petioled, 2–5 cm. long, finely cinereous-puberulent, in age sparingly so; blades spatulate or oblanceolate, entire or sparingly dentate, thin; upper leaves linear-oblanceolate or linear, entire; branches strongly ascending; involucre turbinate, 8 mm. high, 8–10 mm. broad; bracts in 6 or 7 series, linear, acute; green tip short, glandular-puberulent, much shorter than the chartaceous portion, only slightly squarrose; rays rose-purple, about 8 mm. long; achenes finely strigose.

This agrees fairly well with the description of *M. laetevirens* Greene, except that the plant is evidently cinereous-puberulent.

UTAH: Logan, Aug. 9, 1895, *Rydberg* (type, in herb. N. Y. Bot. Gard.).

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GARDEN—No. 132

SPHAEROCARPOS HIANS SP. NOV., WITH A REVISION OF THE GENUS AND ILLUSTRATIONS OF THE SPECIES

By CAROLINE COVENTRY HAYNES

NEW YORK
1910

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL CLUB 37: 215–230. *pl. 25–32.* 2 Je 1910.

[From the BULLETIN OF THE TORREY BOTANICAL CLUB, 37: 215-230, *pls* 25-32. 1910.]

Sphaerocarpos hians sp. nov., with a revision of the genus and illustrations of the species

CAROLINE COVENTRY HAYNES

(WITH PLATES 25-32)

While studying a remarkable *Sphaerocarpos* from the state of Washington, under the direction of Dr. Marshall A. Howe, the writer became gradually acquainted with the other species of this genus of Hepaticae. In the course of this study a considerable amount of material has been available and it has thus been possible to figure and describe all of the known species of *Sphaerocarpos*. The previous literature relating to the genus, especially the works of Nees von Esenbeck, Professor D. H. Campbell, Dr. Howe, and Professor Charles Douin, has been freely consulted and drawn upon. It is hoped that the information thus brought together and the conclusions drawn from it may be of some service to future students of the genus. For living material I am indebted to Professor C. Massalongo, of Ferrara, Italy, and to Professor Francis E. Lloyd, of Auburn, Alabama; freshly collected specimens, also, I owe to the kindness of Professor R. S. Cocks, of New Orleans, Louisiana. Through the courtesy of Monsieur Hariot, I was enabled to examine an authentic specimen of *S. stipitatus* from the herbarium of the Muséum d'Histoire Naturelle of Paris, our illustrations of this species being drawn from it. I must acknowledge, also, my obligations to Professor Douin, of Chartres, France, for numerous pockets of the two French species in various stages of development; to Dr. E. Levier, of Florence, Italy, for excellent specimens from Sardinia and various Italian stations. One of the last mentioned, from Florence, the home of the illustrious Micheli, the author of the name *Sphaerocarpos* and the first botanist to figure and describe one of the species of this genus, has been drawn upon to furnish illustrations of the generic type species. Mr. William E. Nicholson, of Lewes, Sussex, England, has kindly communicated an English specimen of the best known European species. In addition to those already named, one hundred and nine specimens have been examined in the following herbaria: that of the New York Botanical Garden (including those of L. M. Underwood and William Mitten), that of the Sullivant Moss Society, and that of the writer (including that of M. A. Howe).

Miss Lucy MacIntyre and Miss Julia T. Emerson have obligingly aided in making certain translations.

One of the results of this study is to exclude *S. Sphaerocarpos* (*S. terrestris* and *S. Michelii* of authors) from America, as no American specimen has been seen which seems to conform strictly to the characters of this European and possibly North African species. On the other hand, *Sphaerocarpos texanus* (*S. californicus* of authors) appears to have a very wide distribution, specimens from South America, Europe, and Mediterranean Africa being indistinguishable from those of the southern and western United States.

Stephani * gives the following seven species as belonging to the genus *Sphaerocarpos*: *S. terrestris* (Mich.) Smith, *S. Donnellii* Aust., *S. texanus* Aust., *S. Berteroi* Mont., *S. californicus* Aust., *S. cristatus* Howe, and *S. Jamesii* Aust. The last mentioned, Stephani states, was known to him by name only, a specimen being nowhere preserved, though, he adds, it was collected in Mexico. As no reference to such a species has been found in literature, and as Herr Stephani has been unable to give us any clue as to the place of origin of the name, it has been dropped from the list. *Sphaerocarpos texanus* appears to be indistinguishable from *S. californicus*, and, as *S. texanus* was published two years earlier, that name has been adopted. On somewhat similar grounds, though in this case the two names were based on specimens from the same locality, *Sphaerocarpos stipitatus* Bisch. replaces *S. Berterii* Mont. (*S. Berteroi* of Stephani's Species Hepaticarum). To the five species thus remaining from Stephani's list, a sixth, the new species from the state of Washington, alluded to at the outset of this paper, is added below.

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* Bull. Herb. Boiss. 7: 656, 657. 1899.

It should be remarked, perhaps, that *Sphaerocarpos Notarisii*, Mont.* was, a few years after its publication, referred by Montagne to its proper genus *Riella*.

The species of *Sphaerocarpos* are certainly among the simplest and most interesting of the Hepaticae and the importance of the genus from the evolutionary and phylogenetic point of view is clearly set forth in the following quotation from Professor Campbell :†

> "From a review of the preceding account of the Liverworts, it will be apparent that these plants, especially the thallose forms, constitute a very ill-defined group of organisms, one set of forms merging into another by almost insensible gradations, and this is not only true among themselves, but applies also to some extent to their connection with the Mosses and Pteridophytes. The fact that the degree of development of gametophyte and sporophyte does not always correspond makes it very difficult to determine which forms are to be regarded as the most primitive. Thus, while *Riccia* is unquestionably the simplest as regards the sporophyte, the gametophyte is very much more specialized than that of *Aneura* or *Sphaerocarpus*. The latter is, perhaps, on the whole the simplest form we know, and we can easily see how from similar forms all of the other groups may have developed. The frequent recurrence of the two sided apical cell, either as a temporary or permanent condition in so many forms, makes it probable that the primitive form had this type of apical cell. From this hypothetical form, in which the thallus was either a single layer of cells or with an imperfect midrib like *Sphaerocarpus*, three lines of development may be assumed to have arisen. In one of these the differentiation was mainly in the tissues of the gametophyte, and the sporophyte remained comparatively simple, although showing an advance in the more specialized forms. The evolution of this type is illustrated in the germinating spores of the Marchantiaceae, where there is a transition from the simple thallus with its single apical cell and smooth rhizoid to the complex thallus of the mature gametophyte. In its earlier phases it resembles closely the condition which is permanent in the simpler anacrogynous Jungermanniaceae, and it seems more probable that forms like these are primitive than that they have been derived by a reduction of the tissues from the more specialized thallus of the Marchantiaceae. *Sphaerocarpus*, showing as it does points of affinity with both the lower Marchantiales and the anacrogynous Jungermanniales, probably represents more nearly than any other known form this hypothetical type. Its sporogonium, however, simple as it is, is more perfect than that of *Riccia*, and if our hypothesis is correct, the Marchantiales must have been derived from *Sphaerocarpus*-like forms in which the sporophyte was still simpler than that of existing species. Assuming that this is correct, the further evolution of the Marchantiales is simple enough, and the series of forms from the lowest to the highest very complete."
>
> "In the second series, the Jungermanniales, starting with *Sphaerocarpus*, the line leads through *Aneura*, *Pellia*, and similar simple thallose forms, to several types with more or less perfect leaves — e. g., *Blasia*, *Fossombronia*, *Treubia*, *Haplomitrium*. These do not constitute a single series, but have evidently developed independently, and it is quite probable that the typical foliose Jungermanniaceae are not all to be traced

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* In De Not. Mem. R. Accad. Torino II. 1: 343. *f. d. 1–8.* 1839.

† Campbell, D. H. The structure and development of mosses and ferns 157–159. 1905. [ed. 2.]

back to common ancestors, but have originated at different points from several anacrogynous prototypes."

"The systematic position of the Anthocerotes is more difficult to determine, and their connection with any existing forms known must be remote. While the structure of the thallus and sporogonium in *Notothylas* shows a not very remote resemblance to the corresponding structures in *Sphaerocarpus*, it must be remembered that the peculiar chloroplasts of the Anthocerotes, as well as the development of the sexual organs, are peculiar to the group, and quite different from other Liverworts. To find chloroplasts of similar character, one must go to the green Algae, where in many Confervaceae very similar ones occur. It is quite conceivable that the peculiarities of the sexual organs may be explained by supposing that those of such a form as *Sphaerocarpus*, for example, should become coherent with the surrounding envelope at a very early stage, and remain so until maturity. In *Aneura* we have seen that the base of the archegonium is confluent with the thallus, in which respect it offers an approach to the condition found in the Anthocerotes; but that this is anything more than an analogy is improbable. The origin of the endogenous antheridium must at present remain conjectural, but that it is secondary rather than primary is quite possible, as we know that occasionally the antheridium may originate superficially. In regard to the sporogonium, until further evidence is brought forward to show that *Notothylas* may have the columella absent in the early stages, it must be assumed that its structure in the Anthocerotes is radically different from that of the other Liverworts. Of the lower Hepaticae *Sphaerocarpus* perhaps offers again the nearest analogy to *Notothylas*, but it would not be safe at present to assume any close connection between the two. Of course the very close relationships of the three genera of the Anthocerotes among themselves are obvious."

"On the whole, then, the evidence before us seems to indicate that the simplest of the existing Hepaticae are the lower thallose Jungermanniales, and of these *Sphaerocarpus* is probably the most primitive. The two lines of the Marchantiales and Jungermanniales have diverged from this common ancestral type and developed along different lines. The Anthocerotes cannot certainly be referred to this common stock, and differ much more radically from either of the other two lines than these do from each other, so that at present the group must be looked upon as at best but remotely connected with the other Hepaticae, and both in regard to the thallus and sporophyte has its nearest affinities among certain Pteridophytes. The possibility of separate origin of the Anthocerotes from *Coleochaete*-like ancestors is conceivable, but it seems more probable that they have a common origin, very remote, it is true, with the other Liverworts. They may probably best be relegated to a separate class, coördinate with the Hepaticae and Musci."

Those who follow the Vienna Rules of nomenclature will scarcely be inclined to deny that the first effective post-1753 publication of the genus *Sphaerocarpos* is found in Boehmer's edition of Ludwig's Definitiones Generum Plantarum, dated 1760. Strict adherents of the "American Code," however, may discover that *Sphaerocarpos* was not here used in connection with a specific name and that it is not "associable by citation with a *previously published* binomial species." But Ludwig's reference to Micheli, the real founder of the genus, makes the application of the generic name and the type of the genus indisputable. Adanson, who appears to have been the next author to mention the genus, changing the spelling of the final syllable to *us*, meets the American requirements of effective publication no more closely than does Ludwig. The name, in the Michelian sense, appears not to have been used in the binomial form until 1792, though, meanwhile, the name had been appropriated by Bulliard for a genus of Myxomycetes and by Gmelin for a genus of seed-plants. The Michelian genus, however, was soon generally recognized and its acceptance has been so universal that no synonyms for it are to be found in the literature of the Hepaticae. To attempt at this time to rename on account of a possible slight technical flaw a genus so adequately established by Micheli (even though overlooked by Linnaeus) would seem an act of violence to the spirit, at least, of the priority principle. It may be remarked that *-os* and not *-us* is the ending of the generic name as used both by Ludwig and by its originator Micheli, and that there are the same grounds for adopting it as in the case of *Symphoricarpos*, in which that termination has already become familiar. In fact, the retention of the *-os* ending, it would appear, has been made mandatory by both the Vienna Rules (Art. 57) and the "American Code" (Part III, Section I)

SPHAEROCARPOS (Mich.) Ludwig, Def. Gen. Pl. 501. 1760.—
Mich. Nov. Pl. Gen. 4. *pl. 3.* 1729

Sphaerocarpus Adanson, Fam. Pl. **2**: 14. 1763

Gametophores thallus-like, dioicous, annual, small, orbicular to oblong or cuneate, simple or finally once to several times furcate, the broad multistratose midrib passing gradually into the lateral enfolding or inflexed unistratose lobes, intercalary subapical lobes at length nearly equaling the lateral. Cells of gametophore thin-walled, quadrate to long-pentagonal and hexagonal, without trigones. Rhizoids hyaline, smooth, thin-walled, numerous. Sexual organs thickly aggregated along the midrib of dorsal surface of thallus. Antheridial plants minute, scarcely visible to the unaided eye, tinged with purple; antheridia oval, short-stalked, their involucres flask-shaped. Archegonial involucres tubular or clavate to pyriform or subglobose, sessile or long-stipitate. Calyptra ruptured early, a portion with shriveled archegonium-neck long persisting on the apex of capsule. Sporogonium consisting of a globose capsule, an obsolescent stalk, and a bulbous foot,* the last often remaining in the thallus after the detachment of the capsule. Capsule indehiscent, its wall consisting of a single layer of cells destitute of spiral, annular, or other local thickenings. Spores permanently united in tetrads with two exceptions, *S. Donnellii*, in which they become free at full maturity and *S. cristatus*, in which they separate early in the development of the sporogonium; spore-tetrads, when persistent, distinctly areolate, appearing crenulate, papillate or subechinulate in optical section; spores, when separate, compressed-tetrahedral, rounded-lenticular, or sometimes concavo-convex, areolate or cristate, in *S. Donnellii* prominently tuberculate in the basilar circumference. Accompanying the spore mother-cells are smaller starch-bearing sterile cells probably equivalent to elaters morphologically, but lacking a spiral band, these more or less shriveled and obscure at the maturity of the spores.

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* The brood-bodies or gemmae mentioned by various authors, among whom Bischoff gave the best description with figure, this latter being copied by Pearson, are probably to be identified with the bulbous detached basal parts of the sporogonia, which in some species remains in thallus. The "grünlichen drüsenartigen Körper" mentioned and figured by Sprengel (Anleit. Kennt. Gewachse 318. *f. 78.* 1804) are perhaps the oil-bodies which occur here and there in the thallus of *Sphaerocarpos*.

Type species, *Sphaerocarpos Sphaerocarpos* (Dicks.) M. A. Howe.

Key to the species of Sphaerocarpos

- ♀ involucre sessile or subsessile.
  - Spores permanently united in tetrads.
    - ♀ involucre contracted at the apex, the diameter of its orifice much less than that of the involucre; spore-tetrad regularly areolate.
      - ♀ involucre pyriform, obovoid, or subglobose; meshes of spore-tetrad 7–15 μ in diameter, the separating ridges low except at their intersections where they are raised into very acute or acicular spicules. 1. *S. Sphaerocarpos.*
      - ♀ involucre tubular, fusiform-clavate, or rarely subpyriform; meshes of spore-tetrad 15–30 μ in diameter, the separating ridges usually high, sinuous, crenulate, or dissected, or sometimes raised to blunt spines at their intersections. 2. *S. texanus.*
    - ♀ involucre wide-mouthed, the diameter of its orifice equaling or often exceeding that of the subjacent part of the involucre. 3. *S. hians.*
  - Spores separating at maturity, 85–138 μ in maximum diameter, areolate, each while united in the tetrad commonly showing a prominent protuberance about 12 μ high in middle of outer face, and after separation exhibiting a coarsely lobed basilar margin. 4. *S. Donnelli.*
  - Spores separating long before maturity, 52–80 μ in maximum diameter, typically cristate, less commonly irregularly and sparingly areolate. 5. *S. cristatus*
- ♀ involucre distinctly stipitate. 6. *S. stipitatus.*

1. SPHAEROCARPOS SPHAEROCARPOS (Dicks.) M. A. Howe, Mem. Torrey Club **7**: 66. 1899. [With the *-us* ending.]

Targionia Sphaerocarpos Dicks. Pl. Crypt. **1**: 8. 1785. — D.C. Fl. Fr. **2**: 419. 1815. — Poll. Fl. Veron. **3**: 399. 1824.

Sphaerocarpos terrestris, minima Mich. Nov. Pl. Gen. 4. *pl. 3.* 1729. — Dill. Hist. Musc. 536. *pl. 78. f. 17.* 1741.

Sphaerocarpos Michelii Bell. App. ad Fl. Pedem. 52. 1792 (*fide auctorum*); Mém. Acad. Roy. Sci. Turin **5**: 258. 1793; Usteri Ann. Bot. **15**: 87. 1795.

Sphaerocarpus terrestris J. E. Smith, Eng. Bot. *pl. 299.* 1796. — Bisch. *p. p.* Nova Acta Acad. Leop.-Car. Nat. Cur. **13**: 829–838. *pl. 44.* 1827.— Lindenb. *p. p.* Nova Acta Acad. Leop.-Car. Nat. Cur. **18**: 496. *pl. 36.* 1836.— Nees, *p. p.* Naturgesch. Europ. Leberm. **4**: 365. 1838.— Stephani, *p. p.* Bull. Herb. Boiss. **7**: 656. 1899.— Pears. *p. p.* Hep. Brit. Is. 482. *pl. 215. f. 1–14.* 1902. — K. Müller, in Rabenh. Krypt.-Fl. Deutschl. Oesterr. & Schweiz **6**: 316. *f. 190, 191.* 1907. — C. Douin, Rev. Bryol. **30**: 44–57. *f. 8–21.* 1903; **34**: 105–112. *f. 1–3, 11, 15.* 1907; **36**: 37–41. *f. 1–3, 5, 6, 8.* 1909.

Sphaerocarpus lagenarius Dumort. Comm. Bot. 78. 1822.

Sphaerocarpus utriculosus Dumort. *loc. cit.*

Sphaerocarpus terrestris, β? utriculosus Dumort. Hep. Eur. 164. 1874.

Archegonial thallus orbicular to obovate, 0.6 –13 mm. in diameter, densely cespitose, bright green when living, yellowish brown when dried, forking several times, lobes short, orbicular, margin ascending or incurved, marginal cells generally quadrate, 33–66 μ; archegonial involucres 1.5–2.5 mm. high, sessile, thickly crowded together so as almost entirely to conceal the thallus, pyriform, obovoid, or subglobose, orifice small, cells at orifice creniform, quadrate or oblong, 66–85 μ × 39–59 μ: antheridial thallus cuneate to orbicular, 1 mm. in diameter, the rounded lobes curving over the involucres, these 260–330 μ in height, purplish: capsule averaging 750 μ in diameter, the bulbous foot remaining in thallus on detachment of capsule; spores permanently united in tetrads, these 90–120 μ in diameter, greenish or brownish black, finely and regularly areolate, meshes small, 7–15 μ in diameter, each, occasionally, with a single median papilla, ridges low excepting at points of intersection, where they are raised into very acute or acicular spicules, these 7–12 μ in height. [PLATE 25.]

HABITAT: Damp sandy clay; "in clover fields" (England).

TYPE LOCALITY: Florence, Italy.

DISTRIBUTION: Italy, France, Germany, England, and Pantelleria Island (between Sicily and Tunis).

SPECIMENS EXAMINED: Five specimens from Italy, sent by Dr. E. Levier; living specimens from Ferrara, Italy, sent by Professor C. Massalongo; eight specimens from France, sent by Professor C. Douin; a specimen from Baden (between Grötzingen and Weingarten), collected by A. Kneucker; and a specimen from England, collected by W. H. Burrill, and communicated by Mr. William E. Nicholson.

Adherents of the Vienna Rules will use the name *Sphaerocarpos Michelii* for this species, while for those who follow the "American Code," its legal name is clearly that adopted above.

The areolae of the spore-tetrads of this species occasionally show an isolated median papilla or tubercle (see PLATE 25, FIGURE 12). This peculiarity is so pronounced and constant in certain collections that the possibility of its proving a diagnostic character of an unrecognized species at first suggested itself, but it soon became apparent that this character is sometimes only slightly developed (PLATE 25, FIGURE 10) and also that *S. texanus* shows a parallel series of forms (PLATE 27, FIGURES 11 and 15). It may be mentioned, however, that the spicules of some of these peculiar spore-tetrads with unipapillate areolae are less sharply pointed than is normal in *S. Sphaerocarpos*, approaching the blunt spines of certain forms (PLATE 27, FIGURES 19 and 21) which we are inclined to refer to *S. texanus*.

2. SPHAEROCARPOS TEXANUS Aust. Bull. Torrey Club **6**: 158. 1877. — Underw. Bull. Illinois State Lab. Nat. Hist. **2**: 30. 1884. — Stephani, Bull. Herb. Boiss. **7**: 656. 1899.

Sphaerocarpus terrestris Bisch. *p. p.* Nova Acta Acad. Leop.-Car. Nat. Cur. **13**: 829–838. *pl. 44.* 1827. — Lindenb. *p.p.* Nova Acta Acad. Leop.-Car. Nat. Cur. **18**: 496. *pl. 36.* 1836. — Nees, *p. p.* Naturgesch. Europ. Leberm. **4**: 365. 1838. — Pears. *p. p.* Hep. Brit. Is. 482. *pl. 215. f. 1–14.* 1902. — Stephani, *p. p.* Bull. Herb. Bois. **7**: 656. 1899.

Sphaerocarpus Berterii Aust. Hep. Bor.-Am.: Tickets of the specimens 34. 1873. Not *S. Berterii* Bisch.

Sphaerocarpus californicus Aust. Bull. Torrey Club **6**: 305. 1879. — M. A. Howe, Mem. Torrey Club **7**: 65. *pl. 100. f. 9–12.*

1899. — Stephani, Bull. Herb. Boiss. **7**: 657. 1899. — K. Müller, in Rabenh. Krypt.-Fl. Deutschl. Oesterr. & Schweiz **6**: 317. *f. 192.* 1907. — Douin, Rev. Bryol. **34**: 105–112. *f. 4–10, 12, 13, 14.* 1907; **36**: 37–41. *f. 4, 7, 10.* 1909.

Sphaerocarpus Michelii Underw. *p. p.* Bull. Illinois State Lab. Nat. Hist. **2**: 30. 1884.

Sphaerocarpus Michelii californicus (Aust.) Underw. *l. c.*

Archegonial thallus suborbicular or somewhat cuneate, 3–5 mm. × 4–8 mm., densely cespitose, bright green when living, dingy green or sometimes light olive-green when dried, forking several times, the leaf-like unistratose lobes almost entirely concealed by the overcrowding of the involucres, marginal cells generally quadrate, averaging 45 μ; archegonial involucres 1.2–2.6 mm. high, sessile, long-cylindrical, fusiform-clavate, very rarely subpyriform, more or less acuminate, cells at small orifice usually creniform, 45–60 μ: antheridial thallus oblong to orbicular, 2 mm. in diameter, forking several times, the lobes more conspicuous than those of the archegonial plant; antheridial involucres 270–360 μ high, purplish: capsule averaging 675 μ in diameter, the bulbous foot remaining in thallus on detachment of capsule; spores permanently united in tetrads, these 72–171 μ in diameter, golden-brown to dark opaque-brown, regularly areolate, minutely granulate, meshes 13–30 μ in diameter, each, in rare cases, with a single median papilla or tubercle, the ridges finally high, sinuous, crenulate, or deeply and irregularly dissected, occasionally forming obtuse spines at the points of intersection. [PLATES 26 and 27.]

HABITAT: On flat compact commonly lightly shaded soil in meadows and orchards and beside paths.

TYPE LOCALITY: San Marco, Texas.

DISTRIBUTION: United States, Uruguay, England, France, Germany, Sardinia, and Northern Africa (Tangier).

EXSICC: Hep. Bor.-Am. *no. 138*, as *S. Berterii* (in herb. New York Botanical Garden). — Hep. Brit. *no. 215*, as *S. terrestris* (in herb. Underwood). — Hep. Europ. *no. 21*, as *S. terrestris* (in herb. Underwood).

An examination of mature specimens of *Sphaerocarpos* from various parts of the United States leads to the conclusion that the plant described by Austin as *S. texanus* in 1877 cannot be satisfactorily distinguished from the plant that he described as *S. californicus* two years later. The latter name is therefore considered a synonym of the former. Austin himself seems at first to have considered them the same, for in his Hep. Bor.-Am. (Tickets of the specimens, 34. 1873) he cites under "*138. Sphaerocarpus Berteri*" the following stations: "California, *Bolander*, *Bigelow*; Texas, *Wright*." Later he recognized his error in identifying these plants with the very different South American species and described the Texan specimens as *S. texanus* Aust. and the Californian as *S. californicus* Aust. Herr Stephani remarks (Bull. Herb. Boiss. **7**: 656. 1899) that he had not seen *S. texanus*, that it is not preserved in Austin's herbarium in Manchester, that the plant seems to be wholly lost, but that the very small spores ("coccus 63 μ") will make possible its recognition. It has been my good fortune to examine three specimens of *S. texanus* collected by Wright in Texas and now preserved in the herbaria of the New York Botanical Garden and of Columbia University. Two of these came from the Underwood herbarium, one of them being labeled "*Sphaerocarpus texanus* Aust. (type?), San Marco, Tex., C. Wright, 1849, ex coll. W. H. Pearson 1894," and the other "*Sphaerocarpus texanus*, San Marco, Texas, C. Wright, 1849, ex Sulliv." The third is in the herbarium of Columbia University, is labeled "*Sphaerocarpus texanus* Aust. Texas, leg. Wright, ex herb. Aust.," and was communicated by W. H. Pearson in 1890. Austin, in connection with the original description of *S. texanus*, compares it with "*S. Michelii*," stating the *S. texanus* is distinguished by its smaller frond, its involucre less obtuse at the apex, and the spores almost a half smaller. The coccus is described as about 1/400 of an inch (62.5 μ) in diameter, while that of *S. Michelii* is 1/200–1/250 of an inch in diameter. The present writer finds the chief differences separating *S. texanus* from *S. Sphaerocarpos* (*S. Michelii*) to lie in the more pointed fusiform-clavate rather than obovoid involucres, in the meshes of the surface of the spore-tetrads being nearly twice as wide, and in the high ridges forming these meshes being sinuous or crenulate-margined or irregularly dissected, or occasionally rising into obtuse spines at the points of intersection, but never forming sharp needle-like spines as in *S. Sphaerocarpos*. I have not been able to find in the Texan material collected by Wright any spore-tetrads as small as those described by Austin, the smallest seen measuring 72 μ. There is, however, a surprising variation in the size of the tetrads even on a single plant: those in one capsule measured 72–99 μ, while those in another capsule on the same plant measured 92–132 μ; these two sets of spore-tetrads were about equally brown, but the smaller had smaller meshes and lower ridges and it is probable that the plant was killed before these smaller ones had reached full maturity.

As indicated above, *Sphaerocarpos texanus* seems to have a wider distribution than any other species of the genus.

It is of interest to note that the classical descriptions of *S. terrestris* given by Bischoff,* by Lindenberg,† and by Nees ‡ were based, in large part at least, on specimens collected at various times in vineyards near Durlach, Karlsruhe, Baden, by A. Braun. Now it proves that copious specimens collected by A. Braun in this locality in 1834 (the 1834 collection is mentioned by Nees) and preserved in the Mitten Herbarium are clearly *S. texanus* Aust. (see PLATE 27, FIGURE 17), and it may be said that some of the figures published by Bischoff and by Lindenberg point to *S. texanus* rather than to *S. Sphaerocarpos.* It is to be added, however, that the genuine *S. Sphaerocarpos* (*S. terrestris*) — beautifully distinct — also occurs in Baden and near Karlsruhe, as is attested by specimens collected by A. Kneucker on April 21st, 1894, in vineyards between Grötzingen and Weingarten (see PLATE 25, FIGURE 8), and it is possible that both species were represented in the material obtained by Professor Braun.

3. **Sphaerocarpos hians** sp. nov.

Archegonial thallus oblong or orbicular, 4–6 mm. in diameter, growing in isolated groups, bright green when dried, margin lobed and crispate, ascending, marginal cells generally quadrate, averaging 47 μ; archegonial involucres 1–2 mm. high, sessile, not crowded together or entirely concealing the thallus, tubular-ovoid, sometimes slightly larger at apex and slightly flaring, orifice large, of the diameter of the involucre or larger, irregular and entire, cells at orifice 26 × 39 μ, with thick walls: antheridial thallus cuneate to orbicular, 2 mm. in diameter, forking several times, the leaf-like lobes curved over the involucres, these 243–398 μ in height, green becoming brown and purplish with age, their cells, especially those of the neck, thin-walled and nonprotuberant: capsule averaging 587 μ, the bulbous foot remaining attached to capsule; spores permanently united in tetrads, these 66–83 μ in diameter, golden-brown, cristate-reticulate, the crests sinuous, 5 μ high, delicate, somewhat elevated at the angles, occasionally crossing the boundaries of the spores, anastomosing irregularly, forming closed or partially closed meshes or occasionally running in parallel lines toward the boundaries of the spore, a blunt spine occurring now and then within the areolae, the margin in optical section appearing crenulate to tuberculate. [PLATE 28.]

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* Nova Acta Acad. Leop.-Car. Nat. Cur. 13: 829–838. *pl. 44.* 1827.

† *Loc. cit.* 18: 496. *pl. 36.* 1836.

‡ Naturgesch. Europ. Leberm. 4: 365–369. 1838.

HABITAT: Clayey places in copses; on bare alluvial soil in the shade of willows.

TYPE LOCALITY: Pullman, Washington.

DISTRIBUTION: Washington.

SPECIMENS EXAMINED: *C. V. Piper 91*, type, July 2, 1894, and July 21, 1894, both collected at Pullman, Washington, and preserved in the herbarium of the New York Botanical Garden.

This species resembles most closely *Sphaerocarpos cristatus*, differing markedly in the involucre being tubular with a wide or flaring orifice, instead of being subglobose with small orifice, and in the tetrads remaining permanently united, while in *S. cristatus* they separate long before maturity. The spore markings of the two species are somewhat similar, though those of *S. hians* show more regular reticulations.

4. SPHAEROCARPOS DONNELLII Aust. Bull. Torrey Club **6**: 157. 1877. — Underw. Bull. Illinois State Lab. Nat. Hist. **2**: 30. 1884. — Stephani, Bull. Herb. Boiss. **7**: 656. 1899.

Archegonial thallus cuneate, averaging 9 mm. long and 6 mm. in greatest width, forming mats, dark green, faded green when dried, forking repeatedly, lobes large, explanate, margin sinuous, marginal cells generally oblong, 33 × 66 μ; archegonial involucres 2–2.3 mm. high, sessile, not crowded together, somewhat isolated, ovoid-ellipsoid, tubular, truncate at apex, orifice somewhat conspicuous, cells at orifice 39–46 μ: antheridial thallus cuneate, 3 mm. in maximum diameter, each of its five or six main divisions once or twice furcate, lobes large, leaf-like; antheridial involucres 448–996 μ in height, 3 times their diameter, red-brown, cells with somewhat thick walls: capsule averaging 724 μ in diameter, the bulbous foot remaining in thallus on detachment of capsule; spores separating at maturity; spore-tetrad averaging 145 μ in diameter just before separating, provided with a prominence 12 μ in height near the middle of the outer face of each spore, this becoming shriveled at maturity; spores 85–138 μ in maximum diameter, yellow to opaque brown and regularly areolate, coarsely granulate, meshes large, 13–26 μ, the ridges wrinkled and sinuous, forming elevations at points of intersections of meshes, the spores after separation showing a conspicuous coarsely lobed basilar margin. [PLATES 29 and 30.]

HABITAT: Growing on damp sandy soil, in gardens, etc.

TYPE LOCALITY: Jacksonville, Florida.

DISTRIBUTION: Florida and Georgia.

EXSICC: Hep. Amer. *no. 61* (as *Sphaerocarpus terrestris* Mich.) and *no. 62* (as *Sphaerocarpus Donnellii* Aust.).

5. SPHAEROCARPOS CRISTATUS M. A. Howe, Mem. Torrey Club **7**: 66. *pl. 100. f. 1–8.* 1899. — Stephani, Bull. Herb. Boiss. **7**: 657. 1899

Archegonial thallus suborbicular, 3–8 mm. in diameter, pale green when dried, marginal lobes orbicular, ascending, marginal cells generally quadrate, 26–45 μ; archegonial involucres 0.85–1.2 mm. high, sessile, thickly aggregated, at first cylindrical, soon becoming subglobose or obovoid, rounded at apex, orifice small, cells at orifice creniform, 26–40 μ: antheridial thallus cuneate, 2 mm. in diameter, often once furcate, with oblong-ovate lobes; antheridial involucres 498–581 μ in height, about 2.5 times their diameter: capsule 500–800 μ in diameter, the bulbous foot remaining attached to capsule; spores separating long before the maturity of the capsule, never persisting in tetrads, compressed, rounded-biconvex or sometimes concavo-convex, yellowish brown or pale yellow, 52–80 μ in maximum diameter, cristate, the crests sinuous, 4–7 μ high, subcrenulate, mostly radiating from near the middle of each of the two faces, often 1–3 times furcate, sparingly anastomosing, forming sometimes 1–6 (rarely more) completely closed meshes in most cases near the middle of the face. [PLATE 31.]

HABITAT: On flat compact soil in meadows and beside paths.

TYPE LOCALITY: Near Stanford University, Santa Clara County, California.

DISTRIBUTION: California.

EXSICC.: Hep. Am. *no. 160* (as *S. terrestris*, var. *californicus* Aust.) [*S texanus*], a little of which is intermingled in some of the sets in the herbarium of the New York Botanical Garden).

This remarkable species is allied to *Sphaerocarpos hians* from Washington, from which it differs in having spores that separate early instead of remaining permanently in tetrads, in its subglobose archegonial involucre with a small orifice, instead of being long-tubular with orifice the diameter of the involucre. In both of these species the foot remains attached to the capsule on the detachment of the latter from the thallus; the spore markings are somewhat similar. In *S. Donnellii*, the spores separate at maturity, their markings are areolate instead of typically cristate, and they are characterized by a coarsely lobed basilar margin.

The description and drawings published by Professor Campbell in his "Notes on *Sphaerocarpus*" (Erythea **4**: 73–77. 1896) probably relate chiefly to this species.

6. SPHAEROCARPOS STIPITATUS Bisch.; Lindenb. Nova Acta Acad. Leop.-Car. Nat. Cur. **18**: 504 i. *pl. 36.* 1836

Sphaerocarpus Berterii Mont. Ann. Sci. Nat. II. **9**: 39. Ja 1838. — Nees, Naturgesch. Eur. Leberm. **4**: 369. 1838. — Mont. & Nees, in d'Orbigny, Voy. Am. Mérid. **7**^{2}: 50. 1839. — G. L. & N. Syn. Hep. 595. 1846. — Mont. Syll. Gen. Sp. Crypt. 95. 1846.

Sphaerocarpus Berteroi Stephani, Bull. Herb. Boiss. **7**: 657. 1899.

Archegonial thallus suborbicular to oblong, 2 mm. in diameter, in thick cushion-like tufts, light green when dried, margin divided into 4–8 cuneate, ascending, somewhat undulating lobes, marginal cells generally quadrate, averaging 26–39 μ; archegonial involucres 1.5–2 mm. high, distinctly stipitate (the slender stipes 0.5–0.65 mm. long), tubular-ovoid, ellipsoidal, or bluntly conical, more or less narrowed to the truncate apex, fleshy, carnose-opaque, its wall apparently more than one cell thick, orifice large, of nearly the diameter of the involucre, setulose, the hyaline, thick-walled setulae mostly 2 cells long, incurved: antheridial thallus not seen: capsule 340–420 μ in diameter; the persistent spore-tetrads yellowish, coarsely areolate and somewhat roughened, marginate. [PLATE 32.]

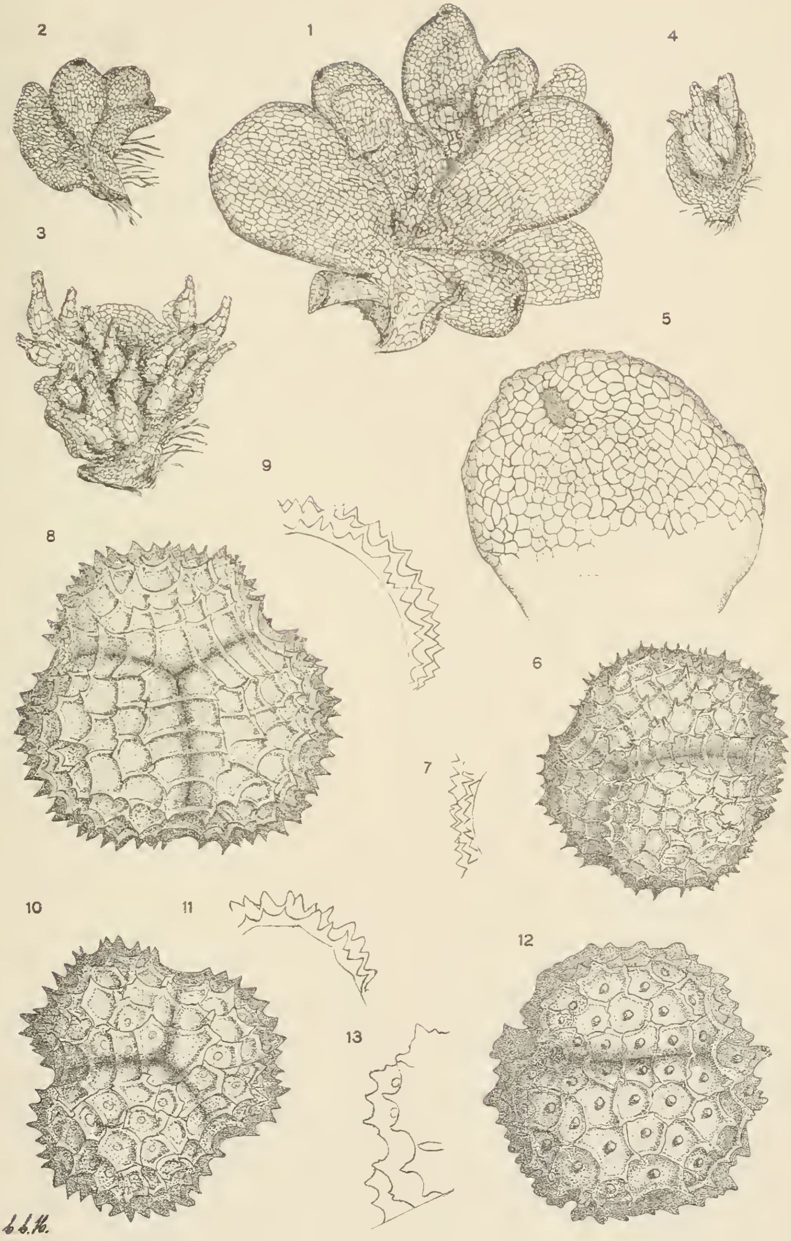
HABITAT: Growing in moist places, on the border of ditches.

TYPE LOCALITY: Quillota, Chile.

SPECIMEN EXAMINED: B. Bertero, *695*, August and September 1829, in the herbarium of the Muséum d'Histoire Naturelle of Paris, France.

The description of the capsule and spores has been derived from literature mentioned above.

NEW YORK BOTANICAL GARDEN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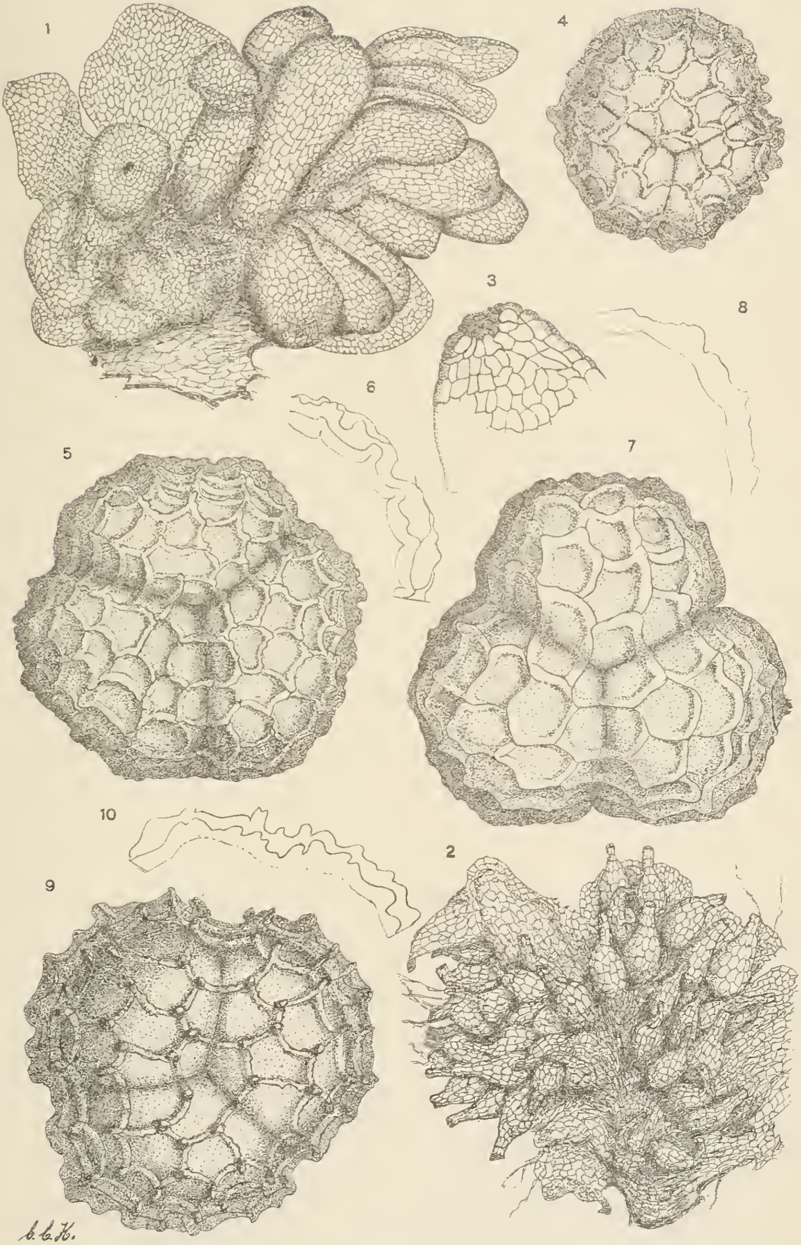
SPHAEROCARPOS SPHAEROCARPOS (Dicks.) M. A. Howe

COCKAYNE—BOSTON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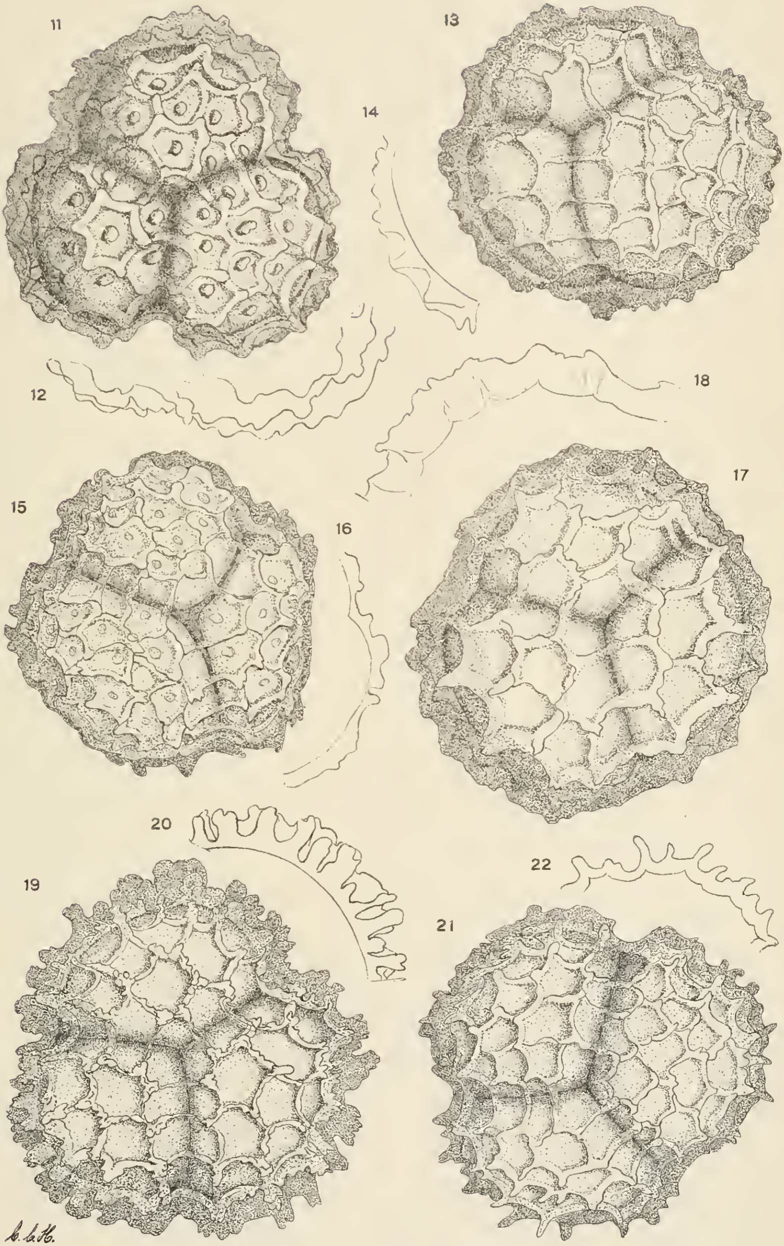
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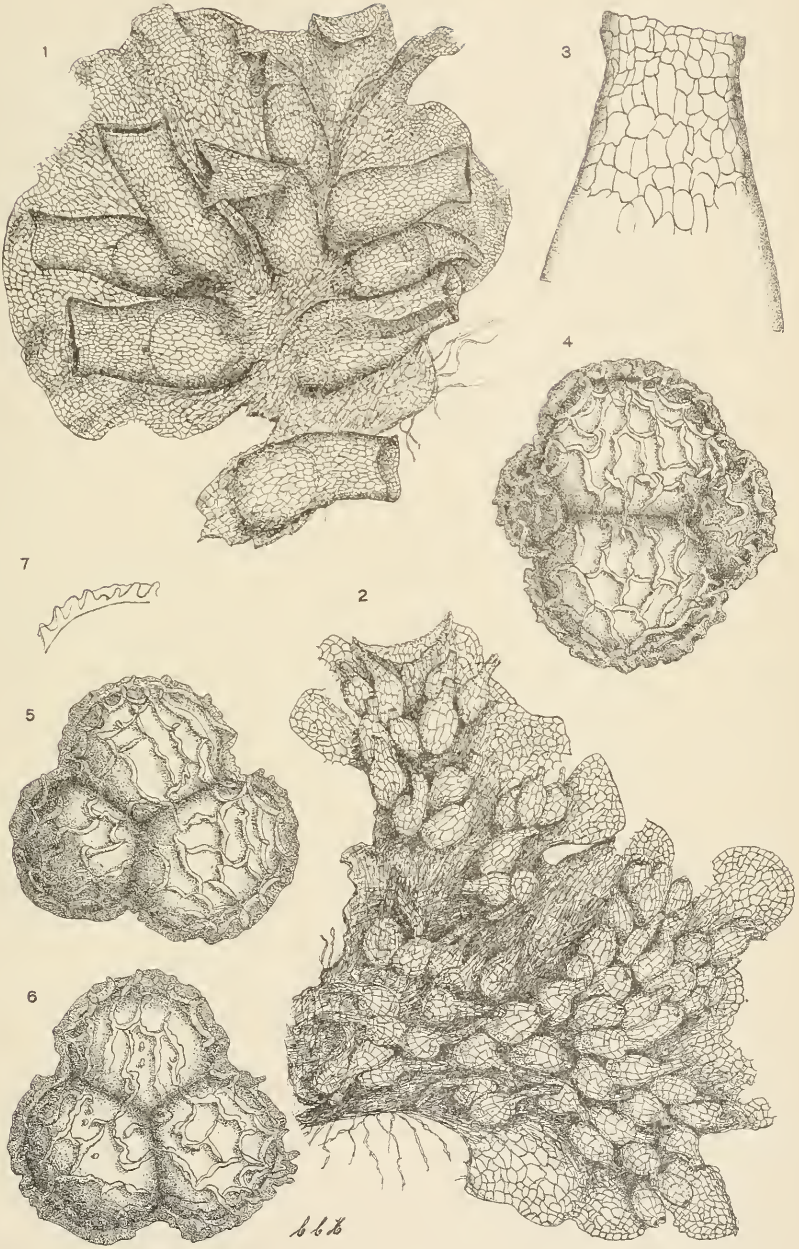

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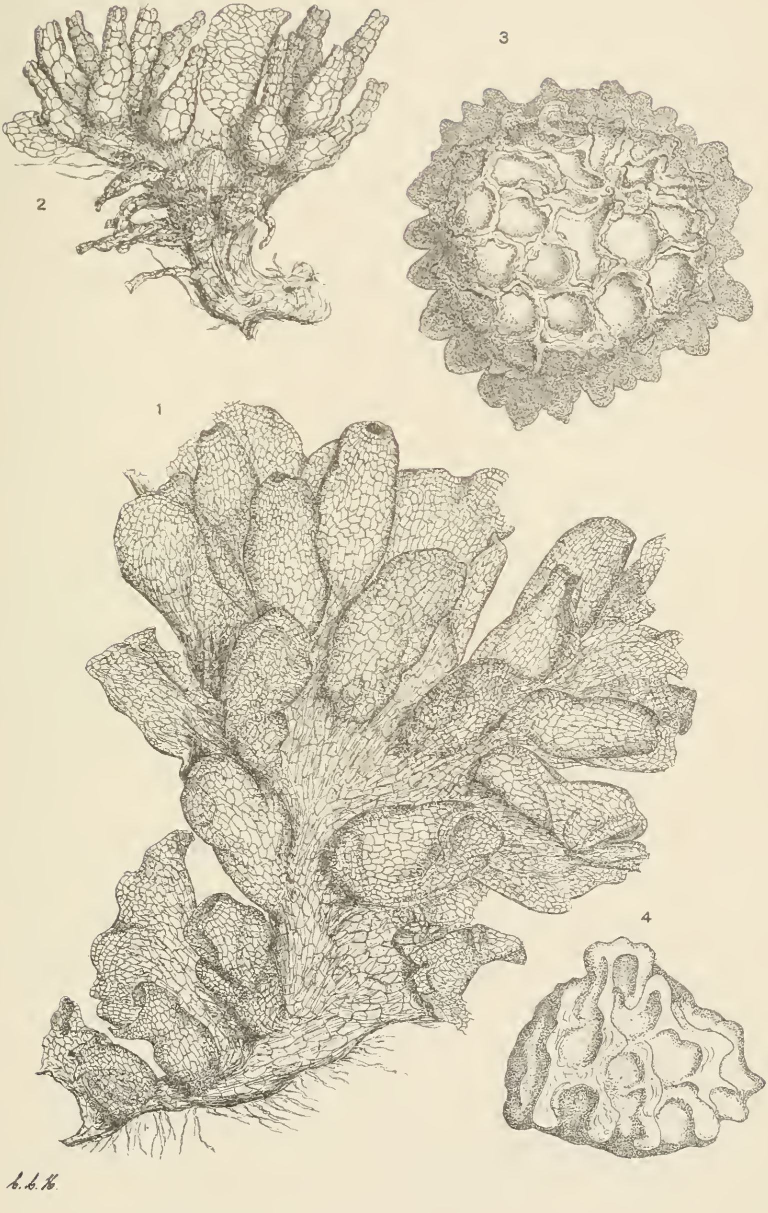

SPHAEROCARPOS DONNELLII Aust.

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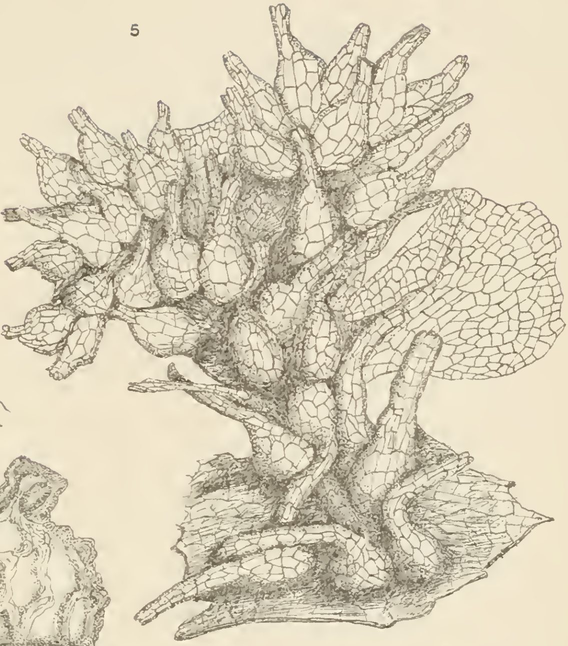

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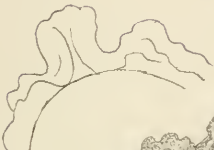

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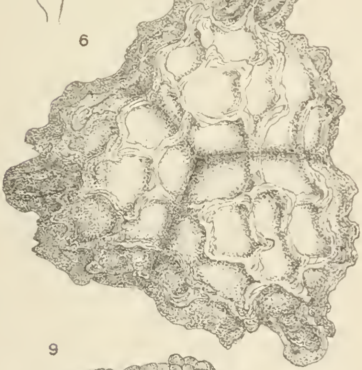

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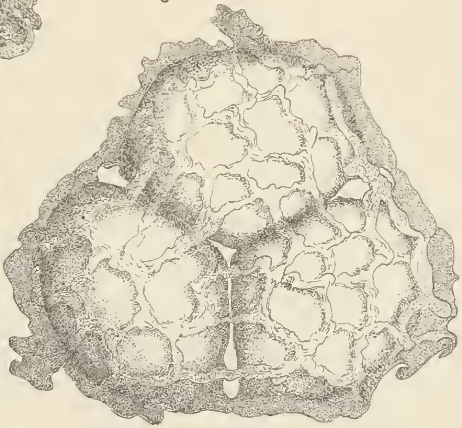

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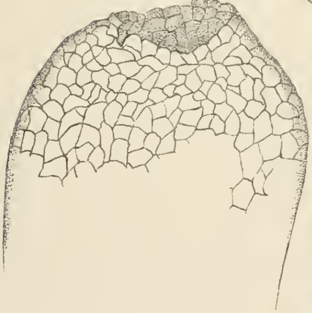

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SPHAEROCARPOS DONNELLII Aust.

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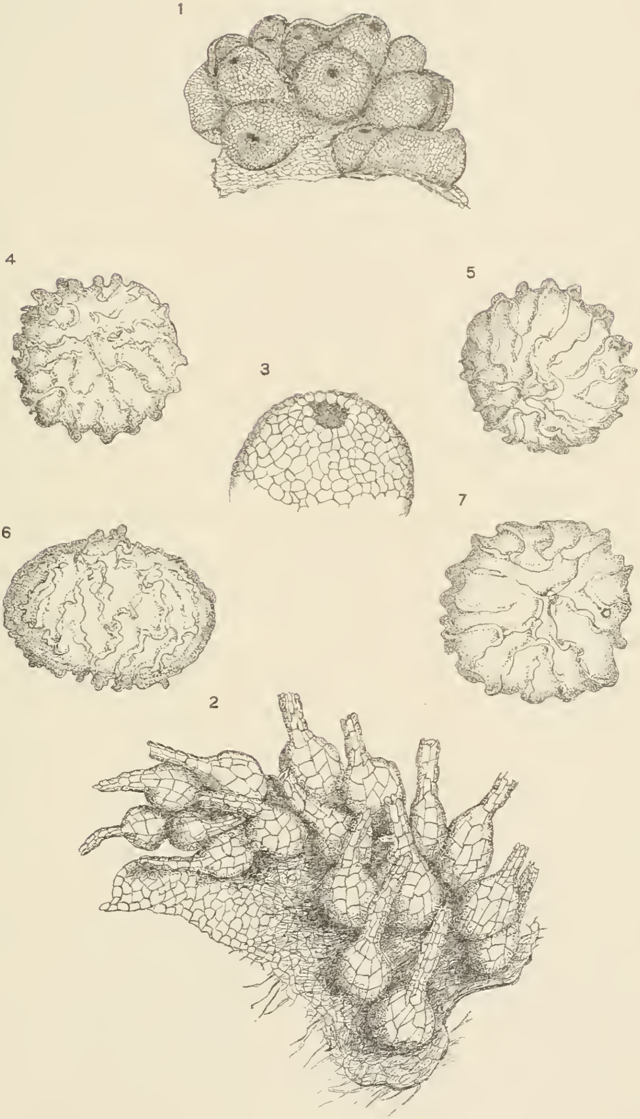
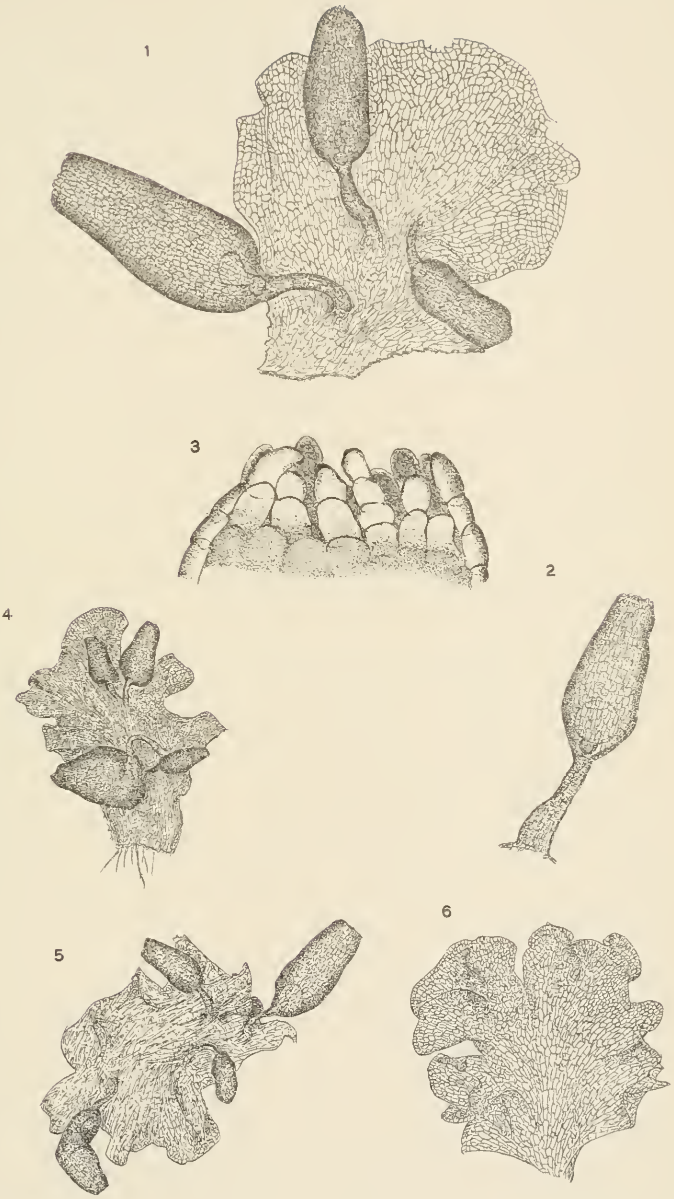


SPHAEROCARPOS CRISTATUS M. A. Howe

COCKAYNE—BOSTON



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SPHAEROCARPOS STIPITATUS Bisch.

COCKAYNE—BOSTON

Explanation of plates

PLATE 25. *Sphaerocarpos Sphaerocarpos*

1. ♀ plant, mature, × 14. 2. ♀ plant, immature, × 14. 3 and 4. ♂ plants, × 29. 5. Orifice of ♀ involucre, × 48. 6, 8, 10, and 12. Spore-tetrads, × 390. 7, 9, 11, 13. Spicules and ridges of spore-tetrads shown in optical section, × 390; 7 was drawn from spore shown in fig. 6; 9, from that shown in fig. 8; 11, from that shown in fig. 10; 13, from that shown in fig. 12.

Figures 1 and 5 were drawn from a specimen collected by O. Beccari, near Florence, Italy, 9 February, 1898; 2, 3, 4, 6 and 7, from a specimen collected by E. Bacci, near Florence, Italy, 9 March, 1888; 8 and 9, from a specimen collected by A. Kneucker, between Grötzingen and Weingarten, Baden, Germany, 21 April, 1894; 10 and 11, from a specimen collected by W. H. Burrill, Strumpshaw, E. Norfolk, England, April, 1908; 12 and 13, from a specimen collected by A. Mori, at Pisa, Italy, December, 1881 (Erb. Critt. Ital., ser. II, *no. 1201*).

PLATES 26 and 27. *Sphaerocarpos texanus*

1. ♀ plant, × 14. 2. ♂ plant, × 29. 3. Orifice of ♀ involucre, × 48. 4, 5, 7, 9, 11, 13, 15, 17, 19, and 21. Spore-tetrads, × 390. 6, 8, 10, 12, 14, 16, 18, 20, and 22. Ridges of spore-tetrads shown in optical section, × 390; 6 was drawn from spore shown in fig. 5; 8, from that shown in fig. 7; 10, from that shown in fig. 9; 12, from that shown in fig. 11; 14, from that shown in fig. 13; 16, from that shown in fig. 15; 18, from that shown in fig. 17; 20, from that shown in fig. 19; 22, from that shown in fig. 21.

Figures 1, 2, 4, 9, and 10 were drawn from specimens collected by C. Wright, at San Marco, Texas, 1849; 3, 7, and 8, from specimens collected by M. A. Howe, Mill Valley, California, 4 April, 1896 (in herb. Haynes); 5 and 6, from a specimen collected by J. Arechavaleta, *no. 151*, at Montevideo, Uruguay, August, 1876 (in herb. Mitten); 11 and 12, from a specimen collected by Welwitsch, *no. 28* [Portugal?] (in herb. Mitten); 13 and 14, from a specimen collected in Tangier in the winter of 1826 (in herb. Mitten); 15 and 16, from a specimen collected by H. A. Green, Chester, South Carolina, 4 March, 1886 (in herb. Haynes); 17 and 18, from a specimen collected by A. Braun, Durlach, Baden, March, 1834 (in herb. Mitten); 19 and 20, from a specimen labeled *S. Micheli*, herb. P. V. LeRoy, Florida (in herb. New York Botanical Garden); 21 and 22, from a specimen collected by Gennari in Sardinia, April, 1889.

PLATE 28. *Sphaerocarpos hians*

1. ♀ plant × 14. 2. ♂ plant, × 29. 3. Orifice of ♀ involucre, × 48. 4, 5, and 6. Spore-tetrads, × 390. 7. Ridges of spore-tetrad shown in optical section, × 390.

The figures were all drawn from the type specimen, collected by C. V. Piper, *no. 91*, Pullman, Washington, 2 July, 1894

PLATES 29 and 30. *Sphaerocarpos Donnellii*

1. ♀ plant, × 14. 2. ♂ plant, × 29. 3. Spore, showing outer face and coarsely lobed basilar margin. 4. Spore, showing tubercular prominence on outer face, in a lateral view, × 390. 5. ♂ plant, showing greatly elongated necks of involucres on old parts of thallus, × 48. 6. Spore-tetrad, nearly mature, × 390. 7. Ridges of spore and tubercular prominence shown in optical section, × 390. 8. Spore-tetrad beginning to separate, × 390. 9. Orifice of ♀ involucre, × 48.

Figure 1 was drawn from a specimen collected by Severin Rapp, in Florida, February, 1905; 5, from Hep. Am. *no. 61*; 2, 3, 4, 5, 6, 7, 8, and 9, from Hep. Am. *no. 62*.

PLATE 31. *Sphaerocarpos cristatus*

1. ♀ plant, × 14. 2. ♂ plant, × 29. 3. Orifice of ♀ involucre, × 48. 4, 5, 6, and 7. Spores, × 390.

The figures were all drawn from the type material.

PLATE 32. *Sphaerocarpos stipitatus*

1. ♀ plant, immature, × 29. 2. ♀ involucre, × 14. 3. Orifice of ♀ involucre, showing setulae, × 120. 4 and 5. ♀ plants, × 14 (drawn to scale of other species). 6. Portion of sterile plant, × 14.

The figures were all drawn from material of the original collection preserved in the Muséum d' Histoire Naturelle of Paris.

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NEW YORK BOTANICAL GARDEN
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CONTRIBUTIONS FROM THE NEW YORK BOTANICAL
GARDEN—No. 133

IOWA DISCOMYCETES

By FRED JAY SEAVER

NEW YORK
1910

Reprinted from the BULLETIN FROM THE LABORATORIES OF NATURAL HISTORY
OF THE STATE UNIVERSITY OF IOWA **6**: 41–219

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INTRODUCTION

The work of the present paper was begun during the autumn of 1902, under the direction of Professor Thomas H. Macbride, in the State University of Iowa. The work was continued during the four years following this period, the first three of which were spent in Iowa City as a student of the University and the fourth at Mt. Pleasant in charge of the biological work in Iowa Wesleyan University. To Professor Macbride and the various members of the botanical department of the State University I am indebted not only for free access to the material in the collections of that department, but for constant suggestions and aid on the numerous questions which have arisen during the course of the work.

Having since taken up my residence in New York City access to the libraries and collections of the New York Botanical Garden has afforded the opportunity to put the manuscript of the Iowa Discomycetes into better form. The library facilities of this institution have made it possible to confirm the citations of nearly all the species named, and to correct determinations in several cases; to the authorities of this institution I wish to acknowledge my indebtedness for the privilege of completing the work begun in Iowa.

A preliminary paper on the Discomycetes of Eastern Iowa was published in the spring of 1904[1] and the present paper stands in part as a revision of that work with the addition of work done subsequent to the time of that publication. The present work includes, not only the work of the writer but all the information which he has been able to accumulate from other sources on this part of the fungous flora of Iowa.

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[1] Bull. Lab. Nat. Hist. State Univ. Ia. V. pp. 335-406.

Since the publication of the Discomycetes of Eastern Iowa, five new species and one variety have been described by various authors based on material collected in connection with this work and this opportunity is taken to bring together all of these facts and publish them as one work. The new species referred to are as follows: *Sphærosoma echinulatum* Seaver, *Schlerotina seaveri* Rehm, *Dermatea olivascens* Rehm, *Gorgoniceps iowensis* Rehm, *Sclerotinia tiliae* Reade, and *Helotium citrinulum seaveri* Rehm. The first of these has since been twice reported from Europe and the second has been collected and studied in New York State.

This work is not intended as a monograph and for this reason no attempt has been made to straighten the many nomenclatural tangles which have arisen, such matters being left to those to whose lot it shall fall to prepare the much-needed monograph of the North American Discomycetes. While an attempt has been made to recognize the first published specific name, where there is a clear case, few new combinations have been made. The question of the validity of several genera has arisen and in some cases noted but it is thought best to leave such matters also to those who may have the time to go into the study of the nomenclature of this group of plants more thoroughly.

The drawings were the most of them made from fresh material and before leaving Iowa. When it became necessary to use dried specimens these were carefully soaked up before using. In the case of large plants the drawing is natural size but when the specimens are very small, both a natural size sketch and an enlarged view have been made to show gross characters. No attempt has been made to draw spores and asci to a common scale throughout. Such drawings are aimed to show the form of the ascus, spore arrangement, spore-form, and internal and external markings. For the relative size of the microscopic characters the reader must depend upon the measurements given with the descriptions.

This article is offered mainly as a guide to local students and while it comprises the sum of the knowledge of the discomycete flora of Iowa so far as I have been able to accumulate it, the subject is a large one and I have reason to believe can scarcely be more than touched upon in an article of this size. It is hoped that other students may take up the work where it is left and carry it on to its completion. To say that there are five hundred species of this group in Iowa would, to my mind, be only a reasonable estimate.

To the various individuals who have contributed to this work acknowledgments are made in the proper place and need not be repeated here. However in addition to the members of the botanical department of the State University of Iowa, I wish to express thanks to Professor L. H. Pammel of Iowa State College for his kindness in loaning to me for study the discomycetes in the Holway collection of that institution.

For characteristics and life-history of the group the reader will consult the Iowa Natural History Bulletin already cited.

CLASSIFICATION

The classification adopted in this paper is for the most part that offered in *Engler & Prantl, Natürlichen Pflanzen Familien* with some variation and the introduction of several genera not recognized in that work. Only such orders, families, and genera are included in the key as are represented by species described in this paper.

KEY TO THE ORDERS.

Hymenium exposed from the first. . . . . I. HELVELLINEÆ.
Hymenium at first closed.
  Hymenium open at an early stage, without firm covering . . . . II. PEZIZINEÆ.
  Hymenium enclosed in a firm covering, opening at maturity.
    Opening with a stellate or irregular aperture III. PHACIDIINEÆ.
    Elongate, opening with a slit-like aperture. IV. HYSTERIINEÆ.

KEY TO THE FAMILIES.

HELVELLINEÆ.

Receptacle borne on a stem.
  Pileus clavate or knob-like; asci non-operculate **1. Geoglossaceae**
  Pileus capitate or pileate; asci operculate. . **2. Helvellaceae**
Receptacle sessile. . . . . **3. Rhizinaceae**

Pezizineæ.

Receptacle fleshy or waxy, rarely gelatinous; ends of paraphyses free.

Peridium and hypothecium of nearly the same structure.

Receptacle open from the first, convex, peridium wanting or poorly developed. . **4. Pyronemaceae**

Receptacle at first concave; peridium developed, fleshy.

Asci at maturity forming an even layer. . **5. Pezizaceae**

Asci at maturity emergent. . . . **6. Ascobolaceae**

Peridium forming a more or less well differentiated layer.

Peridium composed of elongate, thin, bright-walled cells, parallel with each other forming the pseudo-parenchyma. . . **7. Helotiaceae**

Peridium composed of roundish or angular, thin, dark-walled cells, forming a pseudo-parenchyma. . . . . . . **8. Mollisiaceae**

Receptacle leathery or cartilaginous; ends of paraphyses united to form an epithecium.

Receptacle free from the first, never inclosed in a membrane. . . . . . . **9. Patellariaceae**

Receptacle at first submerged, later breaking through the epidermis, cup- or beaker-shaped often at first inclosed in a membrane. . . . . **10. Cenangiaceae**

Phacidiineæ.

Fleshy, white, bright colored, never black, surrounded by the torn edges of the epidermal covering. . . . . **11. Stictidaceae**

Hysteriineæ.

Apothecia free, carbonaceous, black, round or mostly linear. . . . . **12. Hysteriaceae**

KEY TO THE GENERA.

1. Geoglossaceæ.

Receptacle globose or pileate, margin free. . . . Leotia.

Receptacle spoon-shaped, adnate with the stem. . . Spathularia.

2. Helvellaceæ.

Pileus hollow entirely or in the upper part only; cavity of pileus continuous with that of the stem.

Upper surface of the pileus marked by deep pits. Morchella.

Upper surface of pileus spirally folded or convolute. . . . . GYROMITRA.
Pileus membranaceous, bell-shaped or ragged, attached to the stem by the central part only. . . . HELVELLA.

3. RHIZINACEÆ.

Spores globose, root-like processes wanting. . . SPHÆROSOMA

4. PYRONEMACEÆ.

Receptacle seated on a spider-web-like, or felt-like mass of hyphæ, hypothecium well developed, fleshy; peridium poorly developed. . . . . . PYRONEMA

5. PEZIZACEÆ.

Spores globose.
  Receptacle externally clothed with bristly hairs. SPHÆROSPORA.
  Receptacle externally smooth or nearly so, not bristly.
    Receptacle large, cup-shaped, brown. . . DETONIA.
    Receptacle small, nearly plane or disc-shaped. BARLÆA.
Spores elliptical, blunt, rarely pointed.
  Receptacle externally hairy.
    At first buried in the ground, margin splitting. SARCOSPHÆRA.
    Not buried in the ground, margin remaining even. . . . . LACHNEA.
  Receptacle smooth or nearly so externally.
    Cups or discs regular in outline.
      Juice colorless.
        Spores smooth or rough, not reticulate.
          Plants entirely sessile.
            Large cup-shaped. . . . . PEZIZA.
            Small disc-shaped.
              Plants bright colored, spores hyaline. HUMARIA.
              Plants dark colored, spores brown. PHÆOPEZIA.
          Plants stipitate.
            Stem stout, short.
              Stem even, not grooved. . . . GEOPYXIS.
              Stem uneven, with longitudinal grooves. . . . . . ACETABULA.
          Stem long, slender. . . . . . . MACROPODIA.
        Spores reticulate, with a net work, externally. . . . . ALEURIA.
      Juice milky. . . . . GALACTINIA.
    Cups irregular, split on one side. . . . OTIDEA.

6. Ascobolaceæ.

- Spores hyaline.
  - Asci 8-spored.
    - Receptacle smooth or at least not hairy. . . . Ascophanus.
    - Receptacle clothed with hairs. . . . . Lasiobolus.
  - Asci 16 to many-spored.
    - Plants large, 1 to 2 mm. in diameter, at first conical. . . . . Thecotheus.
    - Plants small mostly less than 1 mm. depressed. Rhyparobius.
- Spores at first hyaline becoming purple.
  - Spores free in the ascus. . . . . Ascobolus.
  - Spores united in a ball in the ascus. . . . Saccobolus.

7. Helotiaceæ.

- Receptacle between fleshy and waxy, or waxy, thick or membranaceous.
  - Receptacle fleshy-waxy, bright colored fragile or dull leathery.
    - Plants externally tomentose. . . . . . . Sarcoscypha.
    - Plants externally smooth.
      - Receptacle not springing from a sclerotium.
        - Substratum green. . . . . Chlorosplenium.
        - Substratum not colored. . . . . Ciboria.
      - Receptacle springing from a sclerotium. . Sclerotinia.
  - Receptacle waxy, thick, tough or membranaceous.
    - Externally hairy.
      - Plants stipitate. . . . . Dasyscypha.
      - Plants entirely sessile. . . . . . Trichopeziza.
    - Externally smooth.
      - Spores elliptical to fusiform.
        - Plants slender stipitate. . . . . Phialea.
        - Plants with stem short, stout or wanting. . Helotium.
      - Spores linear or much elongated, many-septate. . . . . Gorgoniceps.
- Receptacle cartilaginous; spores becoming several-celled. . . . . Coryne.

8. Mollisiaceæ.

- Receptacle fleshy-waxy or rarely membranaceous. . . Mollisia.
- Receptacle cartilaginous, horny when dry. . . . Orbilia.

9. Patellariaceæ.

- Spores with transverse septa only.
  - Plants patellate.
    - Spores hyaline 3 to many-septate. . . . Patellaria.

Spores brown 1 to 3-septate.
Spores 1-septate. . . . . Karschia.
Spores 3-septate. . . . . Mycolecidea.
Plants hysteropatelliform. . . . . . Hysteropatella.
Spores muriform. . . . . Blitrydium.

10. Cenangiaceæ.

Plants sessile or subsessile.
Receptacle when fresh, leathery, horny or waxy.
Stroma entirely wanting. . . . . . Cenangium.
Stroma more or less well developed.
Asci 8-spored. . . . . Dermatea.
Asci many-spored. . . . . . . Tympanis.
Receptacle when fresh gelatinous.
Spores simple.
Apothecium within watery, shrinking much when dry. . . . . Sarcosoma.
Apothecium within not watery. . . . Bulgaria.
Spores much elongated, many-septate. . . Holwaya.
Plants stipitate, large, urn-shaped. . . . . Urnula.

11. Stictidaceæ.

Plants elongated; asci 8-spored; spores simple. . . Propolis.

12. Hysteriaceæ.

Spores with transverse septa only.
Spores colored, brown. . . . . Hysterium.
Spores hyaline.
Spores 1-septate. . . . . Glonium.
Spores becoming 3-septate. . . . . . Gloniella.
Spores muriform (with both transverse and longitudinal septa). . . . . Hysterographium.

ORDER I. HELVELLINEÆ.

Receptacle vertical, stipitate, mitrate, pileate, or clavate; hymenium superior, exposed from the first; substance between fleshy and waxy, rarely gelatinous.

FAMILY 1. GEOGLOSSACEÆ.

Receptacle fleshy, waxy, or gelatinous; fructification separated into a sterile stem and fertile receptacle; hymenium on the outside of the receptacle, always exposed; asci clavate, non-operculate.

SPATHULARIA Pers., Tent. Disp. Meth. Fung. 36. 1797.

Receptacle fleshy, stipitate, vertical, compressed laterally, extending down two opposite sides of the stem; spores 8, filiform, hyaline, paraphyses filiform.

One species found in the northeast part of the state.

SPATHULARIA CLAVATA (Schaeff.) Sacc., Michelia 2:77. 1880.

Plate 1, f. I.

Elvela clavata Schæff., Icon. Fung. pl. 149. 1767.

Spathularia flavida Pers., Tent. Disp. Meth. Fung. 3n. 1797.

Receptacle spatulate, compressed, nearly even, yellow; margin often crisped, or undulated, 2 to 5 cm. high; stem light colored, whitish; asci clavate, 8-spored; spores filiform, 50 to 60 by 2 to 3μ, guttulate or granular within; paraphyses filiform, branched, numerous.

On the ground in pine woods, summer; collected by B. Shimek, Winneshiek county.

Plants distinguished by their yellow color. The pileus is flattened laterally so as to be spoon-shaped or spatulate and is often much contorted and twisted.

A note from Mr. Holway after the publication of the Discomycetes of Eastern Iowa states that this species has been found in but one locality in the northeast part of the state, in a piece of pine timber where it grows on the ground among leaves and twigs. This stands as a correction to the statement made in the paper quoted above that these plants are common.

LEOTIA Pers., Tent. Disp. Meth. Fung. 17. 1797.

Receptacle stipitate, gelatinous, pileate, roundish or spreading, revolute, at the margin; hymenium covering the upper surface and margin of the pileus, under surface sterile; hymenium undulated or even; stem cylindrical or laterally compressed; asci clavate, 8-spored; spores fusiform or linear, hyaline.

LEOTIA STIPITATA (Bosc.) Schr., Nat. Pfl. Fam. 1:166. 1897.

Plate 1, f. II.

Tremella (hygromitra) stipitata Bosc., Berl. Mag. 5: 89. 1811.

Plants stipitate, 2 to 4 cm. high by 1 to 2 cm. broad; pileus globose or spreading, smooth, dark æruginous-green; stem long, flattened or twisted, lighter colored than the pileus, yellowish or slightly greenish, covered with minute hair-like structures or nearly smooth; asci clavate, 8-spored; spores guttulate and granular within, 20 by 5μ; paraphyses filiform.

On soil in woods among leaves, summer and fall, Iowa City.

The pileus in this species is very dark green and in some cases so dark as to appear almost black and contrasts strongly with the lighter colored stem. The plants seem to grow for the most part solitary.

Leotia lubrica (Scop.) Pers., Syn. Fung. 613. 1801.

Plate 2, f. I.

Elvela lubrica Scop., Fl. Carn. 2: 477. 1772.

Plants growing in cespitose clusters, stem and pileus more or less irregular in form and appearing tremulous and rather soft; pileus irregular, convolute, at first golden-yellow becoming brownish to greenish when dry, stem and pileus when fresh of nearly the same color; asci cylindrical, 8-spored; spores elliptical to fusoid, 25 by 8μ; paraphyses filiform.

In woods on soil among leaves, Iowa City.

The specimens described here under this name were decidedly different in color and in general appearance from the preceding species. There was no trace of green in the fresh specimens the color resembling that of *Spathularia clavata*, but as the specimens dried they assumed more or less of a green color and those placed in alcohol became quite decidedly green in color. The stems of pileus of this species are much more irregular than those of the preceding species in the specimens observed by us.

FAMILY 2. HELVELLACEÆ.

Plants fleshy, separated into stem and pileus; stem sharply distinguished from the receptacle, for the most part hollow, fragile; receptacle pileate, covered outside with the hymenium, which is always exposed, composed of asci and well developed paraphyses; asci operculate; spores elliptical, hyaline or faintly yellowish.

MORCHELLA Pers., Tent. Disp. Meth. Fung. 36. 1797.

KEY TO THE SPECIES.

Pileus free half way up.	*M. hybrida.*
Pileus not free.	
Stem much smaller than the head, ribs thick, pits deep.	
Plants large, more than 4 cm. high, usually yellow.	
Pits irregular, head rounded.	*M. esculenta.*
Pits longitudinally inclined, head conical. . .	*M. conica.*
Plants small, usually much less than 4 cm. high, cinereous.	*M. deliciosa.*
Stem very much enlarged below, ribs very thin, pits shallow.	*M. crassipes.*

*Morchella hybrida (Sow.) Pers., Syn. Fung. 620. 1801.
Plate 3, f. II.

Helvella hybrida Sow., Eng. Fungi, 238. 1797.

Morchella esculenta (L.) Pers., Syn. Fung. 618. 1801.
Plate 2, f. III.

Phallus esculentus Linn., Fl. Suec. 455. 1755.

Pileus rounded, ovate or oblong, adnate at the base, ribs thick; pits large, deep, irregular; stem even, not much enlarged at the base; asci cylindrical, 8-spored; spores elliptical, 20-22 by 10μ; paraphyses filiform, slightly thickened above.

On the ground in open places among grass, spring, Iowa City and Mt. Pleasant. Probably common throughout the state.

This is much valued on account of its edible qualities and is often gathered in large quantities for this purpose The species is common and the plants very variable in form and size.

*Morchella conica Pers., Trait. Champ. 257. 1818.
Plate 3, f. I.

Morchella deliciosa Fries, Syst Myc. 2:8. 1822.
Plate 2, f. II.

Pileus subconical, ribs rather thick, longitudinally inclined, deep, rather dark colored within, grayish, with the edges of the ribs lighter, yellowish; stem short, scarcely as long as the pileus, slender above and a little enlarged below and more or less irregular, nearly smooth; asci cylindrical, 8-spored, spores elliptical, 20 zy 10μ.

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*Species are described in the preliminary paper already named.

On the ground in grassy places, spring, Iowa City.

This and the following species were collected in the same locality and growing together but were so different in size and general appearance that they would at once be recognized as different species. The pits in this species were decidedly grayish within with the edge of the ribs lighter while in *M. crassipes* the pits and ribs are of uniform color. The great difference in size is also a prominent feature.

Morchella crassipes (Vent.) Pers., Syn. Fung. 621. 1801.

Pileus subconical, yellowish to slightly brownish, adnate at the base; ribs very irregular, thin; pits large, irregular, shallow, of the same color as the ribs; stem very large and irregular, enlarged much toward the base, 10-15 cm. high; spores 20 to 23 by 10 to 12μ.

On the ground in open, grassy places, Iowa City, spring.

This species is quite different from any of the preceding forms. The pits are very large and irregular and the ribs are very thin. The large size of the whole stem is a distinguishing character and this is still more enlarged toward the base and often very irregular in form.

GYROMITRA Fries, Summa Veg. Scand, 346. 1849.

Receptacle pileate, stipitate, margin reflexed, covered above by the hymenium; substance fleshy; stem short, slender, even; asci cylindrical, 8-spored; spores elliptical or elongate-elliptical, smooth; paraphyses filiform.

One species found in the state.

Gyromitra esculenta (Pers.) Fries, Summa Veg. Scand., 346. 1849.

Plate 4, f. i.

Helvella esculenta Pers., Syn. Fung. 618. 1801.

Pileus inflated, irregularly undulated or convolute, brown, margin adnate with the short stem; asci cylindrical, 8-spored;

spores 20 by 10μ; paraphyses enlarged upwards and containing coloring matter.

On the ground, Iowa City.

Several specimens of this species have been collected by Professors Macbride and Shimek. The plants are very attractive from their large size and peculiar form.

HELVELLA Linn., Sp. Pl. ed. 2, 1649. 1763.

Receptacle pileate, supported by the center, deflected, concave and sterile beneath; upper surface of the pileus covered by the hymenium which is even; stem always present, united by the center to the pileus, hollow or filled with cavities; in mature plants pileus compressed, lobate, substance waxy-membranaceous; asci cylindrical, 8-spored; spores elliptical, smooth; paraphyses linear.

KEY TO THE SPECIES.

Stem slender, even. . . . . *H. elastica.*
Stem stout, with deep furrows.
  Plants entirely white or whitish. . . . . . *H. crispa.*
  Plants with pileus dark brownish to blackish. . . *M. lacunosa.*

*HELLVELLA ELASTICA Bull., Champ. 299. 1809.
Plate 5, f. II.

*HELVELLA CRISPA (Scop.) Fries, Syst. Myc., 2:14. 1822.
Plate 5, f. I.

Phallus crispus Scop., Fl. Carn. 2: 475. 1772.

HELVELLA LACUNOSA Afzel. Act. Holm., 304. 1785.

Pileus inflated, unequally lobed, cinereous-black; margin of the pileus adnate with the stem; stem rather slender as compared with the preceding, and often more or less twisted, yellowish, lighter than the pileus; asci cylindrical, 8-spored; spores 1-seriate, elliptical, 18 by 10μ; paraphyses filiform, slender.

On the ground in woods, Iowa City and Mt. Pleasant.

Distinguished from the preceding by the darker pileus and more slender stem. The plants of this species vary much in size, specimens collected in Iowa City are from 2 to 6 cm. high while those collected in Mt. Pleasant were much smaller on the average not more than 2 cm. The color of the pileus also varies somewhat but in all the specimens examined is decidedly darker than the stem.

FAMILY 3. RHIZINACEÆ.

Receptacle fleshy-waxy, brittle, sessile. Hymenium exposed from the first, plane or convex. Asci cylindrical, operculate. Paraphyses numerous, free.

SPHÆROSOMA Klotzsch; Dietrich Fl. Boruss 467. 1841.

Receptacle fleshy, sessile, convolute, roundish, outer surface covered entirely by the hymenium, within sterile. Asci cylindrical. Sporidia spherical, verrucose, hyaline.

SPHÆROSOMA ECHINULATUM Seaver., Jour. Myc. 11: 2-5. 1905.

Plate 6, a—g.

Plants gregarious or scattered, occasionally crowded, sessile, 1 to 8 mm. in diameter; at first almost spherical and regular in outline, becoming convolute with age, especially on the upper surface, often umbilicate; lower surface sterile, nearly plane, attached to the soil near the center by delicate hyphæ, very easily detached; at first white or whitish becoming reddish-brown on the exposed surface, then dark brown; the color begins with a brown spot in the center of the upper surface and spreads until it covers all of the exposed surface; at maturity having a brown velvety appearance due to the large, brownish paraphyses which extend far beyond the asci; under surface light colored; hymenium at maturity covering the exposed surface of the plant, composed of very large asci and paraphyses; asci 40 to 50 by 300 to 500μ, clavate, 8-spored; spores globose, at first smooth, filled with numerous guttulæ, and surrounded with a transparent exospore, gradually becoming rough on the outside, at maturity covered with spines which are several times as long as broad; spines 4 to 5μ in length by 2 to 2.5μ broad at the base, often bent at their apices, at maturity extending to the outer surface of the exospore; spore, excluding exospore 25μ in diameter, including spines or exospore, 35μ in diameter; paraphyses large, clavate, septate, brownish, 12 to 15μ in diameter at the apex; sterile part of the receptacle composed of rather loosely interwoven hyphæ, grading into pseudo-parenchyma; cells large.

Habitat—On the surface of damp soil between the tufts of grass in an open place, in the margins of woods near Iowa City. Plants collected from June to October. Also reported from Europe.

The specific name under which these plants are described is suggested by the character of the markings of the spores, which are distinctly echinulate.

The description and measurements given above were made from fresh material collected at different times. Specimens preserved in alcohol vary somewhat; the most of the color disappears and the plants are a little contracted and the measurements are therefore a little less.

The plants described above were collected during the later part of the month of June in the summer of 1904, in large numbers in a ravine near Iowa City and upon examination were at once referred to this genus. The individuals are at first almost spherical in form, smooth on the outer surface, and of a whitish or lead color. As they mature, a small, brown spot is formed in the center of the supper surface, the brown color gradually spreading until it covers all of the exposed surface. They are at first regular in outline, becoming, at maturity, irregularly convolute and more or less depressed, so that at maturity the plants are roundish but more or less irregular in form, of a deep brown color and with a soft velvety appearance. Examination of sections of young plants shows the brown spot on the upper surface to be the beginning of the development of the hymenial layer and the brown color and velvety appearance to be due to the large paraphyses which contain brown coloring matter.

The writer has not had opportunity to revisit the type locality of this species since the original collection was made in 1904, so that no statement can be made as to its reoccurrence there and so far as noted it has not since been reported from this country. It is interesting to note that one year after the collection of this species in America it was collected in Europe and distributed by Dr. Rehm in his Ascomycetes. It was later collected and distributed the second time. Examination of the foreign material shows it to be identical in every way with that collected in Iowa.

ORDER II. PEZIZINEÆ.

Receptacle well developed, fleshy or more or less leathery, generally regular, at first closed, spherical (except in Pyronemaceae) gradually opening, becoming shallow, cup-shaped or beaker-shaped or disc-like; hymenium forming a covering on the upper, inner surface, composed of asci and paraphyses arranged in the form of a palisade.

FAMILY 4. PYRONEMACEÆ.

Receptacle seated on a mass of thread-like hyphæ; hymenium at length plane or convex; peridium wanting or poorly developed.

PYRONEMA Carus, Nov. Act. Acad. Nat. Cur. 17: 370. 1835.

Receptacle seated on a mass of hyphæ, fleshy, at first spherical, then expanded; peridium very poorly developed or wanting; spores elliptical, hyaline.

KEY TO THE SPECIES.

Plants very small scarcely more than 1 mm. in diameter, pale.	*P. omphalodes.*
Plants 1 to 3 mm. in diameter, dark red.	*P. melaloma.*

PYRONEMA OMPHALODES (Bull.) Fuckel, Symb. Myc. 319. 1869. Plate 7, f. I.

Peziza omphalodes Bull., Champ. France 264. 1809.

Aleuria omphalodes Gill., Discom. 48. 1888.

Pyronema confluens Tul., Carp. 2: 197. 1865.

Plants fleshy, gregarious or confluent 1 mm. in diameter, forming confluent masses 1 to several cm. in diameter; pale red to salmon-color, surrounding mycelium white; hymenium plane or convex; asci cylindrical, 8-spored; spores elliptical, 10 to 12 by 7μ; 2 to 3 guttulate and granular within; paraphyses enlarged upwards and filled with coloring matter.

On charcoal and ashes where fire has been; Iowa City.

The form described in the Discomycetes of Eastern Iowa as *P. aurantio-rubrum* Fuckel was probably rather a poor specimen of the above. After the publication of that paper the present species was found in abundance on burnt places in wet weather. The beautiful salmon-colored patches on burnt ground were quite attractive.

In the winter of 1906 this species was observed commonly in the propagating house of the New York Botanical Garden where it occurred in abundance on soil which had been sterilized by heating. It grew abundantly for a time and finally disappeared. The gardener reported it to be very common but apparently it did no harm.

Also during the autumn of 1907 the species was observed commonly in North Dakota where it occurred on moist soil along roadsides. It seemed to appear here where no traces of fire were evident but it may have followed prairie fires. Usually it is common only on burnt places.

*PYRONEMA MELALOMA (Fries.) Sacc., Syll. Fung. 8:107. 1889.
Plate 7, f. II.

Peziza melaloma Fries., Syst. Myc. 2: 68. 1822.

Saccardo seems to have made a difference between this and *Peziza melaloma* Alb. & Schw. which we have described as *Lachnea melaloma* (Alb. & Schw.) Sacc. The two forms collected by the writer and described under these different names seem to be distinct although both occur on burnt soil and are in other ways similar. Whether they should be placed in different genera is uncertain. The form described here is smaller, of a brighter color and the exterior is not so distinctly hairy.

The plants of this species have been found to be common, and occur in dense crowded masses.

FAMILY 5. PEZIZACEÆ.

Receptacle for the most part borne on the surface, not immersed in the substratum, sessile or stipitate, externally smooth or clothed with hairs, fleshy, at first closed then opening with a small aperture at the top and gradually expanding; peridium and hypothecium composed of loose roundish cells; asci not protruding at maturity, often operculate (opening by a lid-like structure); spores hyaline.

SPHÆROSPORA Sacc., Michelia, 1: 594. 1879.

Receptacle sessile, at first hemispherical, then expanding, externally clother with simple, sharp-pointed, septate hairs; asci cylindrical, 8-spored; spores globose with one large oil-drop; smooth or beset with spines, arranged in one row in the ascus; paraphyses thickened above and filled with colored granules.

In external appearance the plants of this genus resemble those of the genus *Lachnea* but differ in the globose spores. Two forms have been collected by the writer which seem distinct.

KEY TO THE SPECIES

Plants small, mostly 2 to 5 mm. on burnt places. . .	*S. confusa.*
Plants large 5 to 10 mm. in diameter, on damp soil among moss.	*S. scutelloides.*

SPHÆROSPORA (*Sarcoscypha*) SCUTELLOIDES Ellis, Bull. Torrey Cl. 9:18. 1882.

Plate 8, f. I.

Cups gregarious or scattered, hemispherical, then depressed, 5 to 10 mm. in diameter, dark reddish-brown, clothed externally with numerous, short, septate, brown hairs, which are often enlarged near the base; asci cylindrical, 8-spored, 14 by 150 to 160μ; spores globose, 1-guttulate, 13 to 15μ in diameter; paraphyses filiform, enlarged at their apices.

On damp soil in woods among moss, Iowa City.

The plants described here were at first referred to *Sphaerospora confusa* (Cooke) Sacc. but seem to differ from that species in the size of the plants and also in the habitat with perhaps some difference in spore sizes. The plants described here are of about the size and general appearance of *Lachnea scutellata* except that the color is darker more brown than red. These plants were found by the writer in the same place each year while remaining at Iowa City.

Also specimens of the same form were collected during the fall of 1906 in similar localities in the woods of the New York Botanical Garden.

SPHÆROSPORA CONFUSA (Cooke) Sacc., Syll. Fung. 8: 190. 1889.

Peziza confusa Cooke, Mycogr., 69.

On the ground where a pile of wood had been burned, woods, Iowa City.

The plants of this species differ from the preceding mainly in the size of the cups and the habit as well as the habitat. The plants were found in quantity growing in a dense mass on a burnt place. The preceding species occurs on mossy banks in rather sandy places, the cups are more or less scattered, never densely crowded, and much larger. The preceding form has been studied in such localities for several years in succession.

DETONIA Sacc., Syll. Fung., 8:105. 1889.

Cups large, fleshy, expanded, discoid, brown; asci cylindrical, 8-spored; spores globose, hyaline, smooth or rough.

DETONIA TRACHYCARPA (Curr.) Sacc., Syll. Fung., 8:105. 1889. Plate 14, f. I.

Peziza trachycarpa Curr., Trans. Linn. Soc., 24: 493. 1864.

Discina trachycarpa Karst., Act. Soc. Fauna Fl. Fenn., 2: 113. 1885.

Plicaria trachycarpa Boud., Bull. Soc. Myc. France, 1: 102. 1885.

Aleuria trachycarpa Gill., Discom., 207.

Plicariella trachycarpa Rehm. Rabenh. Krypt Fl., 1^3: 996. 1896.

Cups at first closed. soon expanded and nearly plane, umbilicate, scattered, or densely crowded, becoming very irregular with age, often contorted and twisted especially when crowded; hymenium dark brownish-black, more or less uneven; cups externally granular; asci cylindrical, 8-spored; spores globose, about 15μ in diameter becoming very rough with more or less elongated ridges; paraphyses filiform, enlarged upwards and filled with brown coloring matter.

On burnt ground, Iowa City.

The plants of this species were found to be abundant on burnt places during the autumn of 1904 in woods near Iowa City. The plants from which the above description was drawn were collected in woods in which large numbers of trees had been cut and the brush burned in various places. The plants when scattered are nearly plane but when crowded, as they often are they become very irregular with age and the brown mass, often several cm. in diameter, becomes very attractive on account of the peculiar forms which the cups assume. The spores are very rough and close examination shows the roughenings to be in the form of interrupted ridges rather than rounded wart-like elevations.

BARLÆA Sacc., Syll. Fung. 8: 111. 1889.

Plants small, concave or depressed, often becoming convex, not exceeding 1 cm. broad and usually much less, mostly bright colored; asci cylindrical, 8-spored; spores perfectly globose, smooth, reticulate, spinulose or verrucose.

Several species have been collected four of which are described here. The plants of this genus and the genus *Humaria* which differ only in the form of the spores are most beautiful objects for study and the forms which occur in Iowa are numerous but unfortunately on account of the small size of the plants they are often overlooked. The plants of these two genera occur on moist ground often among moss or on entirely naked soil. Mossy banks in, often small, sheltered places by the roadsides furnish a most favorable habitat for these minute plants and scarcely such a place can be found which in the proper season does not furnish some one or many of these delicate forms.

On account of the small size and delicate structure of the plants of this genus they are not easy to preserve in the usual way and for this reason material for comparison is difficult to obtain. Several smooth-spored forms were collected which could not be determined with any degree of certainty and for that reason are not included in this list.

KEY TO THE SPECIES.

- Spores with reticulate markings.
  - Plants large 2 to 5 mm. in diameter. . . . *B. miniata.*
  - Plants small 1 to 2 mm. in diameter. . . . *B. cinnabarina.*
- Spores not reticulate.
  - Spores spinulose, plants yellow. . . . . *B. crec'hqueraultii.*
  - Spores verrucose, plants purplish. . . . . *B. amethystina.*

Barlæa miniata (Crouan) Sacc., Syll. Fung. 8: 111. 1889.
Plate 12, f. I.

Ascobolus miniatus Crouan, Ann. Sci. Nat. IV. 10: 197. 388.

Lamprospora miniata De Notaris, Comm. Critt. It. 1: 388. 1864.

Crouania miniata Fuckel, Symb. Myc. 320. 1869.

Peziza crouani Cooke, Mycogr. 13.

Plants small, 2 to 5 mm. in diameter, at first concave, becoming nearly plane, orange; asci very long, cylindrical to clavate, 150 by 16 to 18μ; 8-spored; spores globose with large central oil-drop, externally delicately reticulated, 15μ in diameter; reticulations regular with the meshes rather small; paraphyses slender, enlarged upwards, filled with orange granules.

On rather sandy soil among moss, Iowa City.

One collection of this species was made in Iowa and the plants are characteristic in every way. The individuals are larger than the other species of the genus here described and the spore-markings are distinct from any of the other forms studied.

Barlæa cinnabarina (Fuckel) Sacc., Syll. Fung. 8: 112. 1889.

Plate 12, f. II.

Crouania cinnabarina Fuckel, Symb. Myc. 2: 64. 1873.

Peziza lætirubra Cooke, Mycogr. 14.

Plants small, not to exceed 1 to 2 mm. in diameter, at first slightly concave or plane becoming convex, bright orange; hymenium at maturity more or less rough with minute pits; asci clavate to cylindrical, 8-spored; spores globose, with 1 large, central oil-drop, externally finally reticulated, 15 to 18μ; reticulations more irregular than in preceding and meshes larger;

paraphyses filiform, slender, enlarged upwards and filled with orange granules.

On the ground among moss, Iowa City, common. Also observed and studied in Indiana.

The plants of this species are smaller than in the preceding, the hymenium at maturity always convex and without definite margin. The spore-markings are characteristic on account of their irregularity and the larger size of the meshes. The species is very common and so far has always been found among moss-plants in gardens and open fields.

BARLÆA CREC'HQUERAULTII (Crouan) Sacc., Syll. Fung. 8: 113. 1889.

Ascobolus crec'hqueraultii Crouan, Ann. Sci. Nat. IV. 10: 194. 1858.

Peziza auriflava Cooke, Mycogr. 16.

Plants similar in size and general appearance to the preceding, entirely smooth, pale orange to salmon-colored, growing in thick groups but never crowded; asci cylindrical, 8-spored; spores globose, clothed externally with numerous minute, sharp spines which are often bent in various ways, seldom entirely straight, 15 to 18μ in diameter; paraphyses filiform or a little enlarged.

On naked clay soil among tufts of grass, Iowa City. Common in one locality.

The plants of this species occurred in one locality in great numbers and were studied during the entire season. The habitat and pale yellow color of the plants seems to be quite characteristic and the spore-markings are still more so. The minute spines with which the spore is covered are very sharp and many of them crooked and bent in various ways. The drawings of the forms collected, which were made before leaving Iowa, compare very favorably with those accompanying the original description which has since been examined.

BARLÆA AMETHYSTINA (Quel.) Sacc., Syll. Fung. 8: 116. 1889. Plate 12, f. III.

Humaria persoonii amethystina Quel., Asc. Franc. Adv. Sci. 14: 451. 1885.

Plants small, 1 to 2 mm. in diameter, purplish, with a delicate whitish margin; hymenium slightly concave of about the same color as the exterior; asci cylindrical, 8-spored; spores globose entirely covered with large wart-like granules appearing very rough; paraphyses slender a little enlarged.

In woods among moss, Iowa City.

The plants of this species are not quite so large as those described by Quelet but the color and the spore-markings are characteristic. The measurements given for the plants of this species in the original description are 3 to 4 mm. in diameter while our specimens scarcely exceed 2 mm. The verrucose markings of the spores of the two specimens are very similar as is also the color of the plants.

SARCOSPHÆRA Auersw., Hedwigia 8: 82. 1869.

Receptacle at first closed and more or less immersed in the ground, gradually opening and often splitting at the margin and becoming subsuperficial; cups externally clothed with flexuose, brown hairs which are more numerous near the base; asci cylindrical, 8-spored; spores elliptical, hyaline, smooth with one oil-drop.

*SARCOSPHÆRA ARENICOLA (Lev.) Lindau; E. & P. Pfl. 1: 182. 1897.

Plate 9, f. II.

Peziza (*Humaria*) *arenicola* Lev., Ann. Sci. Nat. III. 9: 140. 1848.

This species was described and illustrated in the Discomycetes of Eastern Iowa with the note that it had not been found in Iowa but was collected in the adjoining state of Illinois. The species has not yet been collected in Iowa so far as known but is allowed to remain in the list since the illustration occurs on an accompanying plate. This is the only species included in this list which has not been actually collected in the state, this one having been originally included as illustrative of this genus.

LACHNEA Pers., Myc. Eu. 1: 244. 1822.

Plants fleshy or subfleshy, cup-shaped or plane, externally clothed with a covering of sharp, rigid or soft, flexuose hairs which are usually brown but often hyaline; asci cylindrical or clavate, usually 8-spored; spores elliptical to fusiform, hyaline; paraphyses present slender or clavate.

The genus is distinguished from *Peziza* by the presence of the hairs with which the cups are clothed. The forms with hyaline hairs are sometimes placed in a separate genus, *Neotiella.*

Eleven species of the genus are here described one of which has hyaline hairs. Probably many more occur in the state.

KEY TO THE SPECIES.

- Hairs hyaline. . . . . *L. lojkoeana.*
- Hairs colored, pale to dark brown.
  - Hymenium white or whitish.
    - Plants large, more than 2 mm. in diameter.
      - Plants 2 to 3 cm., spores spinulose. . . . *L. hemispherica.*
      - Plants less than 1 cm., spores smooth. . . *L. albo-spadicea.*
    - Plants small, less than 2 mm. in diameter.
      - Spores tuberculose. . . . . *L. paludosa.*
      - Spores smooth. . . . . *L. abundans.*
  - Hymenium red or yellow.
    - Plants 1 cm. in diameter, hairs short.
      - Plants red, hairs rigid.
        - Spores smooth or scarcely roughened. . *L. scutellata.*
        - Spores spinulose. . . . . . . *L. hirta.*
      - Plants pale yellow, hairs flexuose. . . . *L. aurantiopsis.*
    - Plants 1 to 5 mm. in diameter.
      - On dung, hairs often stellate. . . . . *L. stercorea.*
      - On rotten wood, hairs not stellate. . . *L. setosa.*
      - On burnt ground. . . . . *L. melaloma.*

Lachnea lojkæana Rehm, Rabenh. Krypt. Fl. 13: 1045. 1896.
Plate 8, f. II.

Peziza (Sarcoscypha) luteo-pallens Cooke, Mycogr. 85.

Neottiella luteopallens Sacc., Syll. Fung. 8: 191. 1889.

Cups, sessile, at first hemispherical, then expanded, pale orange, 4 to 5 mm. in diameter, externally clothed with hyaline, septate hairs, which are often more or less rigid; asci cylindrical, operculate, 8-spored; spores elliptical, 15 to 17 to 10μ, granular within; paraphyses stout, thickened at their apices, 5 to 7μ in diameter.

On naked soil in woods, also grown in the laboratory on same material.

Two plants were grown in the laboratory from the soil on which the plants were collected in the field. The hymenium is nearly plane but surrounded with a delicate white fringe. The asci are often found to be only 4 or 6-spored.

*LACHNEA HEMISPHERICA (Schaeff.) Gill., Discom. 73. 1879. Plate 9, f. I.

Elvela hemispherica Schæff., Ic. Fung. 2 pl. 151. 1767.

Peziza hemispherica Hoffm., Veg. Crypt. 2: 28. 1790.

Octospora fasciculata Hedw., Laub-Moose, 2, pl. 4-B.

Sepultaria albida Morgan, Jour. Myc. 8: 188. 1902.

On the ground in woods, common.

The plants are at first small and almost entirely globose becoming expanded and hemispherical with age. The species is easily known by the white hymenium and external covering of brown hairs, the plants being about the size of an acorn-cup.

LACHNEA ALBO-SPADICEA (Grev.) Phill., Brit. Discom. 228. 1887.

Peziza albo-spadicea Grv., Fl. Edin. 420. 1824.

Plants sessile, gregarious, at first subglobose becoming expanded and often nearly plane, about 5 to 8 mm., externally clothed with rather soft brown hairs; hymenium white or whitish; asci cylindrical, 8-spored; spores elliptical, smooth, about 20 by 10μ; paraphyses filiform, slender.

On naked soil in shaded places among weeds, Iowa City.

The specimens referred to this species have been collected often but never in large numbers. They resemble somewhat the preceding but are much smaller and the cups which are at first hemispherical become nearly plane with the margin often slightly split. The hairs are softer and not so prominent as in *L. hemispherica*.

Lachnea paludosa (Boud.) Sacc., Syll. Fung. 11: 400. 1895. Plate 11, f. I.

Ciliaria (*Trichophæa*) *paludosa* Boud., Bull. Soc. Myc. France 10: 65. 1894.

Plants thickly gregarious, 1 to 2 mm. in diameter, hemispherical, becoming nearly plane, externally thickly clothed with long, bristly, brown hairs; hymenium whitish or bluish-white; hairs straight, rather sharp-pointed, mostly simple, reddish-brown, as long as 500μ; asci cylindrical, 8-spored; spores 1-seriate, elliptical, at first 2-guttulate, becoming tuberculose with very large wart-like markings giving the spore a scalloped appearance; tubercles 2 to 3μ in diameter, entire spore 22 to 25 by 15 to 17μ; paraphyses enlarged at their apices.

On naked soil in moist places, rather common.

The species described here has often been met with in the vicinity of Mt. Pleasant where the small plants grow in dense masses on damp soil in shaded places. The species is an attractive one although probably not very distinct in its external characters. The bluish-white hymenium contrasts quite strongly with the dark brown hairy exterior. The spore characters however are very distinct from any of the discomycetes studied in this locality. The spores are covered with large wart-like markings which give them a decidedly scalloped appearance, the scallops reaching a size of 2 to 3μ, much larger and more distinct than in any of the other species studied. The original drawings of the plants, hairs, and spores of this species correspond as closely with the specimens studied in Iowa as they could have done if drawn from this material, although the original description was drawn from material collected in France.

In addition to the material collected at Mt. Pleasant, one specimen of this species has been sent in by Mr. S. C. Knupp from Garrison, Iowa.

Lachnea abundans (Karst.) Sacc., Syll. Fung. 8: 186. 1889. Plate 11, f. III.

Peziza abundans Karst., Fauna Fl. Fenn. 10: 124. 1869.

Plants thickly crowded, small 1 to 2 mm. in diameter, externally brownish, clothed with a thick covering of short, rigid, sharp-pointed, pale brown, 1- to 3-septate hairs which reach a length of 200 to 250μ; hymenium dull, pallid, becoming brownish; asci cylindrical, 8-spored, 100 to 125 by 10μ; spores elliptical to ovoid, 1- to 2-guttulate (mostly 2), smooth, 12 to 14 by 7 to 8μ; paraphyses clavate, apex much enlarged, 5 to 7μ in diameter, brownish.

On ground in woods where wood had been burned, Iowa City.

One collection of this species has been made, but the plants occurred in great abundance being closely crowded together on damp soil where a brush-pile had been burned.

*LACHNEA SCUTELLATA (L.) Gill., Discom. 75. 1879.
Plate 10, f. I.

Peziza scutellata Linn., Sp. Pl. 1181. 1753.

Peziza ciliata Hoffm., Veg. Crypt. 2: 25. 1790.

Humaria scutellata Fuckel, Symb. Myc. 321. 1869.

Common on rotten wood.

The species is quite distinct in its scarlet, saucer-shaped plants and still more so in its broadly-elliptical, smooth spores completely filled with oil-drops and granules. The paraphyses also seem to be delicately marked. This is one of the most common species in this locality and is probably widely distributed. Specimens have also been observed by the writer in New York and North Dakota.

LACHNEA HIRTA (Schumach.) Gill., Discom. 75. 1879.

Peziza hirta Schumach., Pl. Saell. 2: 422. 1803.

Cups scattered, sessile, subhemispherical, becoming more or less expanded, externally clothed with septate, brown hairs; hymenium concave or nearly plane, bright red; asci cylindrical, 8-spored; spores elliptical, spinulose, usually 2-guttulate, about 25 by 10μ; paraphyses clavate, filled with colored granules.

On the ground and decaying materials.

The plants described under this name are similar to the preceding in external characters but the hymenium is usually darker. The spores are more narrowly-elliptical and spinulose, the markings resembling those of the spores of *L. hemispherica* (Schaeff.) Gill.

LACHNEA AURANTOPSIS (Ellis) Sacc., Syll Fung. 8: 180. 1889. Plate 11, f. II.

Peziza (Sarcoscypha) aurantiopsis Ellis, Bull. Torrey Cl. 9: 18. 1882.

Plants sessile, about 2 to 3 cm. in diameter, with a coarse, felt-like, black-brown mycelium at the base, cups also clothed with brown hairs; hairs septate, minutely rough toward the ends, flexuose, about 10μ in diameter and of nearly uniform thickness, blunt; hymenium clear, pale yellow, nearly sulphur-yellow, becoming dull orange when dry; asci cylindrical, 8-spored, 175 to 200μ long; spores elliptical, very large, about 15 by 28μ; paraphyses clavate.

On ground, decaying wood and other materials.

The specimens collected in Iowa by Mr. Holway which were referred to this species by Mr. Ellis do not conform well. The spores are smaller, the hairs rigid and the septa more numerous. The plants are also smaller.

Mr. Ellis indicated by a note on this specimen that it might be a form of *Peziza lanuginosa* Bull. The drawings in this paper were made from the type material in the Ellis collection.

LACHNEA STERCOREA (Pers.) Gill., Discom. 76. 1879.

Peziza stercorea Pers. Obs. Myc. 2: 89. 1799.

Plants gregarious or scattered, sessile, at first subglobose, then concave, becoming plane, dull red, clothed externally with a dense covering of brown hairs which are often branched or stellate; asci cylindrical, 8-spored; spores elliptical, smooth, 20 to 22 by 8 to 9μ; paraphyses clavate.

On cow dung.

The species is peculiar in its habitat and the presence of stellate hairs in addition to the ordinary straight ones on the exterior of the plants. Not common.

LACHNEA SETOSA (Nees) Gill. Discom., 75. 1879.

Peziza setosa Nees, Syst. Pilze. 260. 1817.

Plants thickly gregarious, 1 to 4 mm. in diameter, clothed with very long, brown, septate hairs; hairs as long as 600μ, hymenium plane, orange; asci cylindrical, 8-spored; spores elliptical smooth, 17 to 20 by 10 to 12μ filled with oil-drops; paraphyses clavate.

On rotten wood.

A common species on mossy logs in woods, distinguished by the presence of the very long hairs and the orange disc. The spores of this species are very similar to those of *Lachnea scutellata* (L.) Gill. but the external characters are quite different. This species has also been observed by the writer in North Dakota and is probably widely distributed.

*LACHNEA MELALOMA (A. & S.) Sacc., Syll. Fung. 8: 181. 1889.
Plate 10, f. II.

Peziza melaloma A. & S., Conspect. Fung. 336. 1805.

PEZIZA (Dill.) Linn., Sp. Pl. 2: 1180. 1753.

Peziza Dill., Cat. Pl. 76. 1719.

Receptacle at first closed, globose, then opening and becoming more or less cup-shaped or plane, substipitate or sessile, externally smooth, furfuraceous, or occasionally clothed with soft flexuose hairs (never with sharp-pointed bristles), asci cylindrical to clavate, 8-spored; spores elliptical to fusiform, smooth, verrucose, or spinulose; paraphyses filiform, mostly enlarged upwards; plants varying in color, growing on earth, wood or decaying materials of various kinds.

The genus as it has formerly been known has been broken into a number of new genera. Four species belonging properly to this genus are described here, but doubtless many more occur.

KEY TO THE SPECIES.

Plants light colored yellowish or whitish.	
Plants decidedly cup shaped.	*P. vesiculosa.*
Plants becoming repand with hymenium convex.	*P. repanda.*
Plants dark colored, brown or brownish-black.	
Plants large 3 to 10 cm. in diameter, cup-shaped.	*P. badia.*
Plants small less than 2 cm., disc plane.	*P. brunneo-atra.*

PEZIZA VESICULOSA Bull., Champ. France 270. 1809.
Plate 16, f. I.

Aleuria vesiculosa Gill., Discom. 45. 1879.

Pustularia vesiculosa Fuckel, Symb. Myc. 329. 1869.

Cups large, gregarious or cespitose, at first hemispherical becoming expanded, but remaining cup-shaped, margin often contorted and undulate with age, fleshy, very fragile, furfuraceous, externally whitish or often reddish-brown near the margin, with the hymenium darker, yellowish, 2 to 3 cm. in diameter; asci cylindrical, operculate, 8-spored; spores elliptical, smooth, 20 to 22 by 10μ, granular within; paraphyses slender but enlarged upwards, granular within.

On rich ground and dung heaps, Iowa City, common.

The plants of this species are common on manure piles which are mixed with straw and on ground fertilized with such material. The plants are at first hemispherical and very regular becoming very much contorted with age especially when occurring in dense clusters as they often do. In younger specimens the exterior of the cups is very furfuraceous becoming more nearly smooth with age. This was listed in Discomycetes of Eastern Iowa as *Peziza cerea* Sow. which has been described as a variety of this species.

PEZIZA REPANDA Pers., Ic. Pictæ 49. 1806.
Plate 15, f. II.

Aleuria repanda Gill., Discom. 43. 1879.

Plants gregarious but not crowded, with a short but distinct stem; cups concave, nearly white, soon becoming repand and umbilicate, when mature more or less angular, often 3-sided and darker yellowish to brownish, stem obscured by the expanding disc, 2 to 10 cm. in diameter; asci cylindrical, 8-spored; spores elliptical, smooth, 15 to 18 by 10μ paraphyses clavate.

On coal dust in basement, Mt. Pleasant, and logs, Decorah.

This is a species concerning which there is much doubt as to the real nature of the specimens originally referred to it. Specimens collected by Mr. Holway in the northeast part of the state have been referred here. From plants collected in Mt. Pleasant the illustration in this work is drawn, which plants were studied during the entire summer. The cups are at first small with a conspicuous stem and almost perfectly white. Very soon the margin begins to turn back but failing to split the plants from necessity become angular commonly 3-sided. When mature the margin of the cup spreads on the ground so that the stem which was at first conspicuous is entirely obscured the plants at maturity attaining a size of 6 to 8 cm.; the color becomes darker as the plants mature. The characters mentioned in this description seem to be constant in the specimens studied. The plants were found in the basement of the main college building at Mt. Pleasant, the attention of the writer having been first called to them by Mr. Will Handy, a student at the college.

PEZIZA BADIA Pers., Obs. Myc. 2: 78. 1799.
Plate 14, f. II and 15, f. I.

Aleuria badia Gill., Discom. 43. 1879.

Plants gregarious, sessile, at first globose becoming expanded but remaining cup-shaped, margin at first turned inward becoming straight, color internally dark brown, externally lighter colored and pruinose; 2 to 10 cm. in diameter; asci cylindrical, 8-spored; spores elliptical, minutely rough, 15 to 18 by 8μ; paraphyses slender, clavate.

On the ground in woods, rather common.

Small plants, not exceeding 2 cm. in diameter, have often been collected on moist banks in woods, these plants being of a translucent reddish-brown color. One or two collections have been made of specimens which are as large as 6 to 8 cm. in diameter and dull dark-brown. Whether these two forms are the same seems doubtful. The habitat of the two forms is different the small plants occuring on damp naked soil while the larger specimens were found on rich soil in deep woods.

PEZIZA BRUNNEO-ATRA Desm., Ann. Sci. Nat. II. 6: 244. 1836.
Plate 14, f. III.

Plants scattered, sessile, entirely plane with a little depression in the center of the disc; fleshy, fragile, smooth, very dark-colored, brownish-black, 1 to 2 cm. in diameter; asci cylindrical, 8-spored; spores elliptical, minutely rough, 20 by 10μ; paraphyses clavate.

On damp soil in moist shady places.

The plants of this species resemble in color those of the preceding but are somewhat darker. The species is very distinct however in the general appearance of the plants which form small discs on the surface of the soil. This form has often been met with on naked soil among weeds in sheltered places. The spores are also similar to those of *Peziza badia* Pers. but there is some difference in the nature of the roughenings.

HUMARIA (Fries) Sacc., Syll. Fung. 8: 118. 1889.

Humaria Fries (as subgenus) Syst. Myc. 2: 42. 1822.

Plants small, sessile, for the most part bright colored, red or yellow; hymenium plane or convex; asci cylindrical to clavate, 4 to 8-spored; spores elliptical to fusiform.

The genus is distinguished from *Peziza* by the small size of the plants which grow commonly on moist soil among mosses, on naked soil or occasionally on the dung of animals. Four species are described here but the genus is probably represented in Iowa by many more.

KEY TO THE SPECIES

Asci 4-spored.	*H. tetraspora.*
Asci 8-spored.	
Spores fusoid, twice as long as broad. . . .	*H. muralis.*
Spores broad-elliptical, about twice as long as broad.	
Plants externally granular, on dung. . . .	*H. granulata.*
Plants externally nearly smooth, on damp soil.	*H. leucoloma.*

*Humaria tetraspora (Fuckel) Sacc., Syll. Fung. 8: 121. 1889.

Plate 13, f. I.

Ascobolus tetrasporus Fuckel, Hedwigia 5: 4. 1866.

Leucoloma tetraspora Fuckel, Symb. Myc. 317. 1869.

Peziza (Humaria) tetraspora Cooke, Grevillea 3: 73. 1874.

*Humaria muralis (Quel.) Sacc., Syll. Fung. 8: 127. 1874.

Plate 13, f. II.

Peziza (Humaria) muralis Quel., Grevillea 8: 116. 1879.

HUMARIA GRANULATA (Bull.) Sacc., Syll. Fung. 8: 129. 1889.

Peziza granulata Bull., Champ. France 258. 1809.

Ascophanus granulatus Speg., Michelia 1: 235. 1878.

Ascobolus granulatus Fuckel, Symb. Myc. 287. 1869.

Plants sessile, scattered or crowded, at first globose, becoming expanded, externally coarsely granular; hymenium orange; asci cylindrical, 8-spored; spores elliptical, smooth, 20 by 10μ; paraphyses clavate.

On cow dung, Decorah.

The only specimen seen is that in the Holway Collection in the State College at Ames.

HUMARIA LEUCOLOMA (Hedw.) Sacc., Syll. Fung. 8: 118. 1889.

Octospora leucoloma Hedw., Laub-Moose. 2: 17. 1789.

Leucoloma hedwigii Fuckel, Symb. Myc. 317. 1869.

Aleuria leucoloma Gill., Discom. 56. 1879.

Plants gregarious, sessile, 1 to 5 mm. in diameter; hymenium bright orange, slightly concave or plane; asci cylindrical, 8-spored; spores broad-elliptical, smooth, with one very large and conspicuous oil-drop near the center, large, 20 by 12 to 15μ; paraphyses enlarged upwards and filled with orange granules.

On damp soil among moss, Iowa City and Mt. Pleasant.

A common species on the margins of cinder walks overgrown with moss, where they have been found up to the late fall after the ground has been frozen. The plants are closely sessile so that the hymenium is about even with the surface of the soil.

The specimens listed in previous papers as *H. humosa* are probably only a form of this species. The habitat of the two is a little different as well as the size of the plants, but I can see no difference in microscopic characters.

PHÆOPEZIA Sacc., Michelia 1: 71. 1877.

Plants fleshy or subfleshy, sessile, cup-shaped or nearly plane, rarely bright colored, smooth or hairy; asci elongated, 6 to 8-spored; spores simple, elliptical, colored, greenish or brownish.

One species rather common in the state.

PILÆOPEZIA FUSCOCARPA (Ellis & Holw.) Sacc., Syll. Fung. 8: 474. 1889.

Peziza (Humaria) fuscocarpa Ellis & Holw., Jour. Myc. 1: 5. 1885.

Plants sessile, orbicular, 3 to 4 mm. in diameter, externally pruinose-tomentose, olivaceous-yellow; hymenium concave or nearly plane, dark greenish becoming greenish-black, when dry entirely black; asci cylindrical, 65 to 80 by 4 to 5μ; spores elliptical with ends narrowed, often unequal-sided, at first hyaline then greenish to brown, 7 to 8 by 3 to 3.5μ.

On rotten wood, rather common.

This species as described by Ellis and Holway was based on material collected in Iowa. The species was found by the writer to be rather common on rotten wood especially on overturned logs where the wood and soil came into contact with each other. The plants when fresh are decidedly greenish becoming darker with age especially when dry. The spores at maturity are smoky-brown, and in some cases apparently 1-septate. The presence of the two oil-drops makes it difficult to determine whether the spores are truly septate or only apparently so.

GEOPYXIS (Pers.) Sacc., Syll. Fung., 8: 63. 1889.

Geopyxis (subgenus) Pers., Myc. Eur., 1: 224. 1822.

Receptacle funnel-shaped or spreading, for the most part rather large fungi with a distinct stem which is generally short and thick.

One species has been found to be very common on rotten logs in woods.

*GEOPYXIS NEBULOSA (Cooke) Sacc., Syll. Fung., 8: 70. 1889.
Plate 20, f. II.

Peziza nebulosa Cooke, Mycogr., 163.

In woods on rotten logs, Iowa City and Mt. Pleasant.

ACETABULA (Fries) Fuckel, Symb. Myc. 330. 1869.

Acetabula (as subgenus) Fries. Syst. Myc. 2: 43. 1822.

Cups scattered, medium large, supported by a short, thick, deeply furrowed stem; asci long, cylindrical, 8-spored; spores 1-seriate, oblong or ovate, simple, hyaline; paraphyses clavate.

Although this genus is commonly recognized among the discomycetes it is doubtful if it can stand as a valid genus, the name having been previously used as a generic name among the algæ. However it is thought best to leave this matter to be decided upon by those who shall monograph the North American fleshy discomycetes. Two species collected in the state.

KEY TO THE SPECIES.

Veins extending up the sides of the cup nearly to its margin.	*A. acetabulum.*
Veins not extending up the sides of the cup. . .	*A. sulcata.*

ACETABULA ACETABULUM (L.) comb. nov.
Plate 19, f. III.

Peziza acetabulum Linn., Sp. Pl. ed 2: 1650. 1763.

Acetabula vulgaris Fuckel, Symb. Myc. 330. 1869.

Aleuria acetabulum Gill., Discom. 36. 1879.

Helvella acetabulum Quel., Enchir. Fung. 275. 1886.

Cups medium large, 2 to 5 cm. in diameter, with prominent branching veins which extend nearly to the margin of the outside of the cup, with a short, thick stem; stem 1 to 2 cm. long and about 1 cm. thick, deeply furrowed; hymenium brown, externally paler, yellowish; asci cylindrical, 8-spored; spores elliptical, with one large globose oil-drop 18 to 20 by 12μ; paraphyses clavate.

In woods, various localities in eastern Iowa.

The species is very distinct in the ribs which extend from the grooved stem up the sides of the cup. The spores have each one large oil-drop which is so conspicuous that it is at first mistaken for the spore itself. This plant is commonly known under the specific name given by Fuckel although *Peziza acetabulum* is usually cited in the synonym of the species as it was in the Fuckel's description. Since it becomes necessary to cite the name given by Linnæus as a synonym we use this in combination with the genus under which the species is usually described.

ACETABULA SULCATA (Pers.) Fuckel, Symb. Myc. 330. 1869.
Plate 19, f. II.

Peziza sulcata Pers., Syn. Fung. 643. 1801.

Plants stipitate, about 2 cm. in diameter, externally pruinose, light colored, yellowish; hymenium darker, brown; stem 1 to 2 cm. long by 5 to 1 cm. thick, with deep grooves which extend as far as the base of the cup; asci cylindrical, 8-spored; spores elliptical, smooth, 18 to 20 by 12μ; paraphyses enlarged above.

On damp ground in woods, Iowa City.

The species is quite different from the preceding in the absence of veins which extend up the sides of the cup. The stem itself is grooved as in *A. acetabulum* (L.).

Only one collection of this species was made but a number of plants were found.

MACROPODIA Fuckel, Symb. Myc., 331. 1869.

Receptacle cup-shaped or expanded, usually borne on a long, slender stem, externally rough with minute hairs or hair-like outgrowths appearing mealy; hymenium darker than the exterior of the cup; spores elliptical or fusoid.

Two species common in woods.

KEY TO THE SPECIES.

Plants with long, slender stem; spores subelliptical.	*M. macropus.*
Plants with short, thick stems; spores fusiform. . .	*M. fusicarpa.*

MACROPODIA MACROPUS (Pers.) Fuckel, Symb. Myc., 331. 1869.
Plate 19, f. I.

Peziza macropus Pers., Obs. Myc., 1: 26. 1790.

Cups hemispherical then expanded, clothed externally with minute hair-like structures, giving the exterior of the cup and stem a pruinose appearance; hymenium brownish; stem long, slender, tapering upwards, even or lacunose, asci cylindrical, 8-spored; spores fusoid, or elliptical, becoming slightly rough at maturity, about 30 by 10 to 12μ; paraphyses enlarged upwards.

On the ground in woods, Iowa City and Mt. Pleasant.

The plants of this species are rather common but usually not abundant. They are recognized at once by the cup which is supported by the long slender stem. There seems to be a small form of this species which is rather common but does not grow larger than 1 to 2 cm. in height.

MACROPODIA FUSICARPA (Ger.) Durand, Jour. Myc. 12: 28. 1906.

Plate 21, f. I.

Peziza fusicarpa Ger., Bull. Torrey Cl., 4: 64. 1873.
Peziza (*Sarcoscypha*) pubida B. & C., Grevillea 3: 153. 1875.
Macropodia pubida Sacc., Syll. Fung. 8: 159. 1889.
Lachnea fusicarpa Sacc., Syll. Fung. 8: 172. 1889.
Peziza velutina Berk. & Curtis, Bot. N. Car. 132. 1867.
Peziza morgani Massee; Morgan, Jour. Myc. 8: 190. 1902.

Cups scattered or thickly crowded, nearly hemispherical, shortly stipitate, 1 to 2 cm. in diameter; hymenium dark brown to purplish, darker when dry; externally clothed with short, brown, septate hairs, giving the plant a mealy appearance; hairs longer near the base; asci cylindrical, 8-spored; spores fusiform, rough with 2 oil-drops, granular within, 38 to 42 by 10μ; paraphyses slender, enlarged upwards.

On the ground in woods, Iowa City and Mt. Pleasant, also studied in New York state.

The stem is short and generally covered with long, brown hairs, and immersed in the ground so that the cups seem to be entirely sessile. In the field the plants resemble somewhat those of *Lachnea hemispherica* (Schæff.) Gill., but are distinguished by the dark colored hymenium and by the sofe hairs instead of the sharp bristly ones which are found on the cups.

In the Discomycetes of Eastern Iowa it was suggested that *Peziza morgani* Massee might be identical with this species which has since been found to be the case, and several previous notes made on it in various numbers of the Journal of Mycology and Proceedings of the Iowa Academy of Sciences. The above synonomy is taken largely from Durand (Jour. Myc. 12: 28) in which he goes still farther and makes both supposed species synonymous with *Peziza fusicarpa* Ger.

This is a very common and interesting species.

ALEURIA Fuckel, Symb. Myc. 325. 1869.

Receptacle cup-shaped, often irregular, externally pruinose, usually bright-colored; asci cylindrical to clavate, 8-spored; spores at first smooth, becoming rough and at maturity delicately reticulated.

This genus was founded by Fuckel on *Peziza aurantia* Pers., a reticulate-spored *Peziza,* and although not mentioned by Fuckel this character has come to be recognized as the characteristic of the genus or subgenus as the case may be.

Two reticulate-spored forms occur in the state.

KEY TO THE SPECIES.

Plants small, about 1 cm., spores 1-guttulate. . . .	*A. aurantia.*
Plants large, more than 2 cm., spores 2-guttulate.	*A. rutilans.*

ALEURIA AURANTIA (Pers.) Fuckel, Symb. Mye. 325. 1869.

Peziza aurantia Pers., Syn. Fung. 637. 1801.

Plate 17, f. I.

Cups subsessile, at first regular, becoming irregular with age, 2 to 5 cm. in diameter, externally whitish; hymenium deep orange; asci cylindrical, 8-spored; spores elliptical, 1-seriate, 2-guttulate, at first smooth becoming reticulated, 15 to 17 by 8μ; paraphyses slender, enlarged upwards, filled with orange granules which give color to the hymenium.

In grassy places, Iowa City, also in woods.

This is probably one of the most attractive and best known forms of the discomycetes. Its large size and unusually bright color makes it easy of detection. The species is probably rather common throughout North America. A specimen was received by the writer from Dr. T. C. Frye of Seattle, Washington, with the statement that it occurred in abundance on the campus of the State University. During the present season the same species has been collected and studied by the writer in New York City. These go to indicate a wide distribution.

ALEURIA RUTILANS (Fries.) Gill., Discom. 53. 1879.

Plate 17, f. II.

Peziza rutilans Fries., Syst. Myc. 2: 68. 1822.

Gregarious, sessile, or with a short stem, about .5 to 1 cm. in diameter, externally clothed with very few minute white hairs; hymenium bright orange; asci cylindrical, 8-spored; spores elliptical, 1-guttulate, externally covered with net-like reticulations, giving the spore a roughened appearance, 22 to 25 by 12μ; paraphyses slender, enlarged upwards, filled with orange granules.

In woods among moss (*Polytrichum*), Iowa City, rather common.

Specimens described under this name are vecry interesting. The plants are distinct from the preceding in the size, habitat, and in their more decidedly stipitate character. They have always been found by the writer among the same kind of moss and in some cases were thought to grow from the stems of the mosses among which they are more or less immersed, but this could not be determined with certainty.

The plants described here have reticulate spores similar to those of the preceding. In the Discomycetes of Eastern Iowa this fact was mentioned and illustrated with the statement that in no available description were the spores of *Peziza rutilans* Fries described as being reticulate although they were always described as rough.

Since that statement was made a reference has come to hand (Grevillea 22: 108) in which the description drawn from a specimen named by Fries as *Peziza rutilans* states that the spores are delicately reticulated. The specimens described here conform well in that particular with authentic material, a point concerning which the writer was in doubt at the time the first record of the species was published.

In some respects these plants resemble more closely those of *Peziza polytrichi* Schum. The plants especially when young are quite hairy often with a distinct white fringe around the margin but older specimens are more nearly smooth or only slightly downy. The stem-like base is also a prominent character.

GALACTINIA (Cooke) Sacc., Syll. Fung., 8: 106. 1889.

Galactinia Cooke (as subgenus). Mycogr., 253.

Receptacle sessile, cup-shaped, entire, fleshy, when wounded exuding a milky, colored juice; asci cylindrical, 8-spored; spores elliptical hyaline.

One species common in Iowa.

GALACTINIA SUCCOSA (Berk.) Sacc., Syll. Fung., 8: 106. 1889. Plate 16, f. II.

Peziza succosa Berk., Not. Brit. Fungi. No. 156 (reprint from Ann. Mag. Nat. Hist. 1841).

The plants of this species are not striking in external appearance but are easily distinguished by the bright yellow, milky juice which exudes when the flesh is broken. There seems to be two varieties of this species distinguished mainly by the difference in size. The one is small, scarcely reaching a size of 2 cm. in diameter and the cups very regular and almost perfectly hemispherical in form. The other is much larger often reaching a size of 4 to 5 cm. and the cups are not perfectly hemispherical but the sides are more nearly straight giving the plant more or less of a funnel-shaped appearance. Whether the two forms are entirely distinct is uncertain.

OTIDEA (Pers.) Fuckel, Symb. Myc., 329. 1869.

Otidea (subgenus) Pers., Myc. Eu. 1: 220. 1822.

Receptacle large, elongated or split on one side nearly to the base; cups more or less stipitate, scattered or densely crowded; asci cylindrical, 8-spored; spores elliptical, smooth, hyaline with one or two oil-drops; paraphyses clavate or bent in the form of a hook at the apex.

KEY TO THE SPECIES.

Plants large, hymenium brown, paraphyses, hooked. . . .	*O. leporina.*
Plants comparatively small, yellowish, paraphyses straight.	*O. ochracea.*

*OTIDEA LEPORINA (Batsch) Fuckel, Symb. Myc., 379. 1869.

Peziza leporina Batsch, Elench. Fung., 1: 118. 1783.

The large cups much elongated on one side are very good characters by which the present species may be distinguished.

*Otidea onotica ochracea (Fries) Sacc., Syll. Fung. 8: 95. 1889.

Plate 18, f. i.

Peziza onotica ochracea Fries, Syst. Myc., 2: 48. 1822.

The plants examined occur in dense clusters and the cups are split entirely to the base. The paraphyses are nearly straight, not hooked as in the preceding.

FAMILY 6. ASCOBOLACEÆ.

Receptacle generally sessile on the substratum, at first closed, later more or less expanded, nearly always found on dung; peridium thin or wanting; hypothecium for the most part well developed, consisting of roundish cells; asci at maturity protruding beyond the surface of the hymenium, generally operculate; spores hyaline or purple, globose to elliptical, smooth or marked with wart-like projections or reticulations.

This is one of the most interesting families of all the discomycetes. The plants are usually very small in size but occurring, as they do, on the dung of various animals may be detected by the guidance of the substrata on which they occur. The plants of the family seem to have the ability to endure long periods of extreme dryness and to spring into life again with the return of moisture. The group is of unusual interest on account of the ease with which the plants may be cultivated in the laboratory.

About twenty species of the family have been studied in Iowa most of which were first studied from material cultivated in artificial cultures. Later many of the same species were collected in the field.

In addition to the forms described here one species has been observed and studied by the writer in New York which is of some interest. This species was *Streptotheca boudieri* Vaill. which is the only representative of the genus, having been collected on (rabbit?) dung.

ASCOPHANUS Boud., Ann. Sci. Nat. V. 10: 241. 1869.

Receptacle at first closed then expanded, fleshy or fleshy-gelatinous, externally smooth or minutely granulated (not hairy); hymenium at maturity plane or convex; asci cylindrical or clavate, operculate, 8-spored, protruding beyond the surface of the hymenium at maturity; spores elliptical, hyaline, smooth or sometimes slightly rough, in one or two rows in the ascus.

The plants of the genus usually occur on dung of different animals. Five species are here described.

KEY TO THE SPECIES.

Plants very small, scarcely visible with lens.	
Spores 7 to 8μ long, paraphyses globose. . .	*A. microsporus.*
Spores 10 to 13μ long, paraphyses pyriform. .	*A. granuliformis.*
Plants 1 to 2 mm. in diameter, easily visible.	
Receptacle cinereous to blackish.	*A. cinereus.*
Receptacle flesh-colored to red.	
Plants commonly on old hemp, paper, etc. .	*A. testaceus.*
Plants commonly on dung.	*A. carneus.*

***Ascophanus microsporus** (Berk & Br.) Phil., Brit. Discom. 307. 1887.

Plate 27, f. II.

Ascobolus microsporus Berk & Br., Not. Brit. Fungi. No. 1087. Ann. Mag. Nat. Hist. 1865.

Common in the field both at Iowa City and Mt. Pleasant.

Ascophanus granuliformis (Crouan) Boud., Ann. Sci. Nat. V. 10: 245. 1869 (reprint p. 55).

Ascobolus granuliformis Crouan, Ann. Sci. Nat. IV. 10: 195. 1858.

Plants minute, globose or hemispherical, pale yellowish, translucent, smooth; asci small, very wide, oblong, narrowed at the base, 8-spored; spores hyaline, smooth, elliptical, 10 to 13 by 7μ; paraphyses simple or branched, pear-shaped at the apices.

On cow-dung Decorah, Iowa. E. W. D. Holway.

The only specimen of this species seen is the one in the Holway collection, at Ames, Iowa. Probably not uncommon but easily overlooked.

The species derives its name from the fact that the plants appear like minute grains on the substratum.

*Ascophanus cinereus (Crouan) Boud., Ann. Sci. Nat. V. 10: 249. 1869.

Plate 28, f. I.

Ascobolus cinereus Crouan, Ann. Sci. Nat. IV. 10: 194. 1858.

Grown on horse-dung in culture in the laboratory, also since collected in the field.

The species is quite easily distinguished from any of the other forms described here by the cinereous or blackish color of the plants.

During the fall of 1906 a fine collection of this species was made on horse-dung in a wet swampy place in North Dakota.

*Ascophanus testaceus (Moug.) Phill., Brit. Discom. 310. 1887.

Plate 27, f. I.

Peziza testacea Moug.; Fries, Elench. Fung. 2: 11. 1827.

Ascobolus testaceus Berk. & Br.. Not. Brit. Fungi, No. 1082.

Ascobolus testaceus Berk. & Br.. Not. Brit. Fungi. No. 1980. (Reprint from Ann. Mag. Nat. Hist., 1865).

Abundant collections were made on old sacking, building paper and cloth.

The color of these plants varies according to conditions; they are generally bright red but often pale. The color becomes brighter as the plants dry. A piece of old sacking found near the experiment station at Lafayette, Indiana, was almost entirely covered with the plants of this species. It was also found on heavy building paper in a damp place.

During the fall of 1905 this species was collected in good quantity on old building paper and sacking at Mt. Pleasant, Iowa. and during the autumn of 1906 the same species was again collected on a similar habitat in North Dakota.

Ascophanus carneus (Pers.) Boud., Ann. Sci. Nat. V. 10: 250. 1869. (Reprint p. 59).

Ascobolus carneus Pers., Syn. Fung., 676. 1801.

Scattered or rarely crowded, minute, sessile, flesh-red, smooth, at first globose then flattened; hymenium convex, papillate, immarginate; asci broad, clavate, attenuated below, 8-spored; spores elliptical, smooth or very minutely roughened, hyaline, about 18 by 10μ; paraphyses enlarged upwards, septate.

On cow-dung, Iowa City and Mt. Pleasant.

The species was found to be very common about Mt. Pleasant. The plants when moist are pale reddish but when dry become bright red and easily seen. The species is quite similar to the preceding but differs in the habitat with slight differences in morphological characters.

LASIOBOLUS Sacc., Bot. Cent. 18: 220. 1884.

Receptacle similar to that of *Ascophanus* but externally clothed with sharp-pointed hairs.

Two species collected in the state, one of which is very common.

KEY TO THE SPECIES.

Hairs long, numerous and conspicuous.	*L. equinus.*
Hairs obscure, few and inconspicuous.	*L. raripilus.*

*LASIOBOLUS EQUINUS (Muell.) Karst., Act. Soc. Fauna Fl. Fenn. 2: 122. 1885.

Plate 32, f. I.

Elvela equina Mueller, Fl. Dan. pl. 779. 1782.

Ascobolus pilosus Fries, Syst. Myc. 2: 164. 1822.

Peziza papillata Pers., Syn. Fung. 650. 1801.

Ascobolus ciliatus Kunze & Schm., Myc. Heft 90. 1817.

These plants have been collected in large quantities on the usual (dung) substratum during the entire season. The plants vary much in color so that this seems unreliable as a specific character. They often occur densely crowded on the substratum or more or less scattered. The paraphyses also vary much often being branched several times and in other cases entirely unbranched.

*LASIOBOLUS RARIPILUS (Phill.) Sacc., Syll. Fung. 8: 537. 1889.

Plate 32, f. II.

Ascobolus raripilus Phill., Grevillea 7: 23. 1878.

THECOTHEUS Boud., Ann. Sci. Nat. V. 10: 235. 1869.

Receptacle waxy, sessile, at first conical in form and almost pointed above, later expanding, becoming cylindrical and about as broad as high; hymenium erumpent, immarginate, subpruinose, at first plane, then convex, rough with crystalline points, which are the emergent asci; asci large, elongated and broad, 32-spored, becoming much exserted; spores hyaline, each surrounded by a mucilaginous membrane.

The genus is represented by a single species which occurs commonly in Iowa. The genus is distinguished from *Ryparobius* by the larger size of the plants and their peculiar conical form when young, also by the erumpent hymenium.

THECOTHEUS PELLETIERI (Crouan) Boud., Ann. Sci. Nat., V. 10: 236. 1869.

Plate 33, f. I.

Ascobolus pelletieri Crouan, Ann. Sci. Nat. IV. 7: 173. 1857.

Ryparobius pelletieri Sacc., Syll. Fung. 8: 542. 1889.

Gregarious or scattered, conical, then cylindrical, dirty whitish to gray, externally pruinose; hymenium at first slightly concave, then plane or convex; asci few, very large, cylindrical, operculate, stipitate, 300 to 320 by 50 to 60μ; spores 32 in each ascus, arranged three to four abreast in irregular rows, large, attenuated at each end, often filled with large guttulæ, or granular, 23 to 24 by 35 to 38μ, paraphyses slender, branched.

Grown on cow-dung in the laboratory, Iowa City, also collected on horse-dung Mt. Pleasant; rather common.

The plants of this species were grown several times under glass in the laboratory at Iowa City previous to the publication of the Discomycetes of Eastern Iowa. They are at first white or nearly so and taper to a point at the apex which gradually spreads out until the plant becomes cylindrical with the hymenium convex. When mature the whole plant is from 2 to 3 mm. in diameter and about the same in height.

RYPAROBIUS Boud., Ann. Sci. Nat. V. 10: 237. 1869.

Receptacle, minute (usually less than 1 mm.) at first globose, then expanded or depressed, white or whitish, externally smooth or downy; asci cylindrical, or very broad and elliptical, present in small numbers, generally operculate, 16 to many-spored; spores elliptical or fusiform, hyaline, smooth; paraphyses slender, colorless.

Three species of the genus have been studied in Iowa.

KEY TO THE SPECIES.

Asci 16-spored.	*R. sexdecimsporus.*
Asci more than 16-spored.	
Asci 64-spored.	*R. pachyascus.*
Asci many-spored, number indefinite. . . .	*R. crustaceus.*

*Ryparobius sexdecimsporus (Crouan) Sacc., Syll. Fung. 8: 541. 1889.

Plate 34, f. I.

Ascobolus sexdecimsporus Crouan, Ann. Sci. Nat. IV. 10: 195. 1858.

Ascophanus sexdecimsporus Phill., Brit. Discom. 311. 1887.

*Ryparobius crustaceus (Fuckel) Rehm, Ber. Naturh. Ver. Augsburg 26: 17. 1881.

Plate 33, f. II.

Ascobolus crustaceus Fuckel, Hedwigia 5: 4. 1866.

Ryparobius pachyascus Zukal; Rehm, Hedwigia 27: 167. 1888.

Plate 34, f. II.

Gregarious or scattered, very minute, scarcely visible with the lens, 70 to 90μ in diameter, partly immersed, yellowish-brown; asci few in each plant, 3 to 5, broad, acute at the base, not stipitate, 70 to 76 by 32 to 35μ, many-spored; spores minute, elliptical, 5 to 7 by 3μ; paraphyses not distinct.

Grown on cow-dung in the laboratory, Iowa City.

Plants very small and could not be distinguished except as they were collected with other species. The number of asci in each plant is small varying from three to five. The entire ascus is filled with the spores which seem to be arranged radially around the outside of the ascus. The exact number of spores in each ascus could not be made out but there are more than 64. The paraphyses if present were indistinct.

ASCOBOLUS Pers., Obs. Myc., 1: 33. 1796.

Receptacle fleshy-gelatinous, at first closed, globose, later more or less cup-shaped or plane, externally smooth, furfuraceous or clothed with soft hairs; asci cylindrical or clavate, operculate, protruding at maturity, spores elliptical, smooth reticulate or verrucose, at first hyaline then purple and at last brown; paraphyses scarcely enlarged upwards; plants generally found on dung but often occuring on decaying plant materials; hymenium dotted with the end of the asci containing dark colored spores.

KEY TO THE SPECIES.

Plants very minute about 1 mm. or less in diameter, smooth. . . . . *A. glaber.*
Plants externally furfuraceous or pilose.
  Plants minute slightly hairy, spores very large to 50μ. . . . . *A. immersus.*
  Plants furfuraceous, spores not to exceed 30μ.
    Spores rough, verrucose or reticulate.
      Spores verrucose, plants on burnt ground. . *A. carbonarius.*
      Spores delicately reticulate.
        Plants light colored, yellowish-green, on dung. . . . . *A. stercorarius.*
        Plants dark colored, greenish to brownish, on soil. . . . . *A. viridis.*
    Spores smooth, plants on horse-dung. . . . *A. leveillei.*

*ASCOBOLUS GLABER Pers., Obs. Myc. 1: 34. 1796.
Plate 31, f. II.

The plants of this species which are from .5 to 1 mm. in diameter were found growing sparingly on the material described above. When growing they appear as small globose, shining dots but removed from the substratum they are found to be pyriform, the lower part of the plant being immersed. The spores of this species are similar to those of *Ascobolus stercorarius* (Bull.) Schroet. but are easily distinguished by the surface markings. The spores of the former are marked by a few branching reticulations which are for the most part longitudinal while in the latter they extend in any direction and are much more numerous, giving the spore a decidedly roughened appearance.

*ASCOBOLUS IMMERSUS Pers., Obs. Myc., 1: 35. 1796.
Plate 31, f. I.

Ascobolus macrosporus Crouan, Ann, Ann. Sci. Nat., IV. 7: 173. 1857.

Ascobolus gigasporus De Notaris, Comm. Critt. It., 1: 360. 1863.

ASCOBOLUS CARBONARINS Karst., Not. Fauna Fl. Tenn. 11: 202. 1870.

**Ascobolus atro-fuscus* Phill. & Plow., Grevillea 2: 186. 1873.
Plate 29, f. I.

Plants found growing on the banks of the Iowa River near Iowa City, where a brush pile had been burned, also later collections made where fires had been in various localities. The plants are usually densely crowded on or surrounding the pieces of charcoal with which the soil is mixed. They are very dark brown in color and rough on the outside.

A note was added by Phillips and Plowright in their original description cited above as follows: "We have little doubt of this being the same plant referred to by Mr. Boudier (l. c.) as *Ascobolus viridis* Curr.; it differs so much in sporidia, colour and habitat from Mr. Currey's species that we venture to consider it distinct."

Later *Ascobolus viridis* Curr., or what was suspected to be this, was collected by the writer on clay soil in other localities along the Iowa River in moist places and it was never suspected that this might be identical with *A. atro-fuscus* Phill. & Plow. until this note was read. In addition to the differences mentioned by Phillips and Plowright the spores of *A. viridis* are reticulate and in *A. atro-fuscus* we have seen no signs of reticulations but the spores are beautifully verrucose. It would seem that the two forms are distinct, but the illustration of Boudier conforms more closely to the description of *Ascobolus atro-fuscus* Phill. & Plow. than to that of *Ascobolus viridis* Curr.

Ascobolus viridis Curr., Trans. Linn. Soc., 24: 154. 1864.
Plate 30, f. I.

Plants sessile, plane or very slightly concave, nearly flat, 1 to 5 mm. in diameter, yellowish or greenish-yellow, becoming brown; externally furfuraceous and darker, brownish; asci clavate, 125 to 150 by 20 to 22μ, tapering into a rather long stem, 8-spored; spores elliptical or slightly accuminate, at first hyaline and granular within, becoming purple, then brown, when mature marked with net-like reticulations, 21 to 27 by 12μ, 1- to 2-seriate, when mature crowded together; paraphyses slender, simple or branched, granular within, surrounded by greenish-yellow mucus.

On the damp, clay soil, on the banks of the Iowa River, from June until late autumn, Iowa City, common.

The following is the original description of this species: "On clay ground; sessile, one-third of an inch wide, plane or very slightly concave, of a dark dingy yellowish green colour, externally very furfuraceous, almost tomentose; spores elliptical-accuminate, rugose-striate, amethyst purple."

Our plants conform very closely to this description but are a little smaller.

Ascobolus stercorarius (Bull.) Schroeter, E & P. Nat. Pfl. 1^1; 198. 1897.
Plate 29, f. II.

Peziza stercoraria Bull. Herb. France, pl. 376, f. 1. 1787.

Ascobolus furfuraceus Pers., Obs. Myc. 1: 33. 1796.

Plants sessile, globose, then expanded, 1 to 5 mm. in diameter, externally pale yellow, covered with bran-like particles, especially near the margin; hymenium concave, sometimes plane or slightly convex, same color when young, becoming dark with age on account of the dark colored spores; flesh very brittle; asci clavate, emergent; spores elliptical, reticulate, violet, then brown, 20 to 25 by 10 to 12μ; paraphyses filiform, septate, imbedded in sulphur-yellow gelatine.

On old cow-dung in pastures and woods, also grown in culture.

A very common species and easily recognized by the yellowish plants which are covered with dark dots, the ends of the emergent asci filled with dark purple spores. The plants occur scattered or densely crowded and vary much in size.

ASCOBOLUS LEVEILLEI Boud., Ann. Sci. Nat., V. 10: 225. 1869.
Plate 30, f. II.

Plants thickly gregarious, small about 1 mm. in diameter or less, globose or expanded, externally brown, very rough almost pilose; hymenium dark with the emergent asci; asci 100 to 125 by 25μ, clavate, 8-spored; spores elliptical, smooth, at first hyaline, then purple and at last brown, 24 to 25 by 12μ paraphyses filiform, simple or branched, granular within.

On horse-dung, June, 1904, Iowa City.

These plants were referred to *Ascobolus brunneus* Cooke in An Annotated List of Iowa Discomycetes but they seem to conform more closely to the above. The general appearance of the plants as well as the spore characters conform very well to the illustration given with the original description cited above. The plants were collected in considerable mass on horse-dung.

Saccardo describes the spores of this species as being delicately reticulated. Neither the original description nor the illustrations accompanying it show this character, but the spores are represented as being entirely smooth as they are in our plants.

Our specimens were collected, described and the illustration drawn before the original description of this species was seen but in all points the descriptions conform unusually well.

SACCOBOLUS Boud., Ann. Sci. Nat. V. 10: 228. 1869.

Receptacle similar to *Ascobolus*, externally smooth; asci emergent, operculate, clavate, often stipitate, 8-spored; spores elliptical to fusiform, at first hyaline, then purple, at last brown, smooth, united into one globular mass in the ascus; plants generally occurring on dung.

KEY TO THE SPECIES.

Plants golden-yellow. . . . . *S. kerverni.*
Plants violet. . . . . *S. violacens.*

*SACCOBOLUS KERVERNI (Crouan) Boud., Ann. Sci. Nat., V. 10: 229. 1869.

Plate 28, f. II.

Ascobolus kerverni Crouan, Ann. Sci. Nat. IV. 10: 193. 1858.

SACCOBOLUS VIOLACEUS Boud., Ann. Sci. Nat., V. 10: 230. 1869

Ascobolus violascens Gill., Champ. France, 141. 1888.

Plants scattered or gregarious, minute, 1 to 2 mm. in diameter, smooth, soft, violet; hymenium convex of the same color as the exterior; asci broad more slender near the base, operculate, 8-spored; spores elliptical, subacute, at first hyaline, becoming violet to blackish, smooth, 15 by 9μ, enclosed in a common hyaline membrane; paraphyses violet, pyriform at the apex.

On cow-dung, Iowa City and Mt. Pleasant, rather common.

This species is very distinct from the preceding in the general color of the plants which are violet instead of golden-yellow, also the spores are a little smaller and darker. Several collections of the plants of this species have been made in Iowa by the writer.

FAMILY 7. HELOTIACEÆ.

Plants for the most part superficial, more rarely erumpent or produced from a sclerotium, sessile or stipitate, smooth or hairy; substance waxy or membranous or stout, composed of thin-walled, bright colored cells which form a pseudoparenchyma; cups at first closed, gradually becoming expanded; asci 8-spored. opening with a pore; spores globose to filiform, 1-8-celled.

SARCOSYPHA Fries, Sacc. Syll. Fung. 8: 153. 1889.

Sarcoscypha Fries (as tribe), Syst. Myc. 2: 78. 1822.

Sarcoscypha Cooke (as subgenus), Mycogr. 258.

Plants generally gregarious or tufted, more or less long-stipitate, receptacle generally cup-shaped becoming nearly plane in some cases, externally hairy; asci cylindrical, 8-spored; spores elliptical, usually smooth, hyaline, 1 to 2-guttulate; paraphyses slender, branched, enlarged above; plants usually bright colored, growing on decaying wood.

Three species common in Iowa.

KEY TO THE SPECIES.

Externally clothed with long rigid hairs. . . . . *S. floccosa.*
Externally clothed with soft flexuose hairs, or nearly naked.
  Cups large, 3 to 4 cm.; stem short, thick. . . . *S. coccinea.*
  Cups medium sized, 1 to 2 cm.; stem slender, usually long. . . . . *S. occidentalis.*

***SARCOSYPHA FLOCCOSA** (Schw.) Sacc., Syll. Fung. 8. 156. 1889.

Plate 22, f. I.

Peziza floccosa Schw., Trans. Am. Phil. Soc. II. 4: 172. 1832.

***SARCOSCYPHA COCCINEA** (Scop.) Sacc., Syll. Fung. 8: 154. 1889.

Plate 21, f. II.

Elvela coccinea Scop., Fl. Car. 2: 479. 1772.

Peziza coccinea Jacq., Fl. Austr. 2, pl. 163. 1774.

Lachnea coccinea Gill., Discom. 66. 1879.

Geopyxis coccinea Massee, Fung. Fl. York. 252. 1905.

On partially buried sticks in the woods, fall and spring, Iowa City and Mt. Pleasant. Also observed in North Dakota.

***SARCOSYPHA OCCIDENTALIS** (Schw.) Sacc., Syll. Fung. 8: 154. 1889.

Plate 22, f. II.

Peziza occidentalis Schw., Trans. Am. Phil. Soc. II. 4: 171 1832.

On decaying sticks in woods, spring and summer, Iowa City, Mt. Pleasant, and Des Moines, Iowa. Also observed in North Dakota.

CHLOROSPLENIUM Fries, Summa Veg. Scand. 356. 1849.

Plants sessile or shortly stipitate, concave or plane, bright yellow to olivaceous or aeruginous-green, often staining the substratum green; asci clavate, 8-spored; spores ovoid to fusoid, simple, hyaline.

Three species of the genus not uncommon in Iowa.

KEY TO THE SPECIES.

Plants entirely sessile, bright to olivaceous. . .	*C. chlora.*
Plants stipitate or substipitate, æruginous or olivaceous-green.	
Plants bright æruginous-green.	*C. æruginosum.*
Plants dull olivaceous-green.	*C. versiforme.*

CHLOROSPENIUM CHLORA (Schw.) Massee, Jour. Linn. Soc. 35: 116. 1901.

Plate 23, f. III.

Peziza chlora Schw., Schr. Nat. Ges. Leipzig. 1: 122. 1818.

Chlorosplenium schweinitzii Fries, Summa Veg. Scand. 356. 1849.

Peziza crocitincta Berk. & Curtis; Berkeley, Grevillea 3: 160. 1875.

Plants thickly gregarious, soft, rather fleshy, at first closed and globose in form, then expanded but remaining concave with the margin incurved, bright yellow externally or often more or less faded; hymenium becoming greenish; cups appearing rough on the exterior but not hairy, 1 to 2 mm. in diameter; asci stipitate, 8-spored; spores 1-seriate, hyaline, simple, straight or curved, 5 to 6 by 1.5μ; paraphyses slender, slightly enlarged at their apices.

On old stumps especially oak, Iowa City and Mt. Pleasant, common.

Although this species is the type of the genus *Chlorosplenium* as founded by Fries the general appearance of the plants would scarcely suggest that genus as it is understood at the present time. The plants are usually very bright yellow, often orange-yellow with perhaps a slight tinge of green displayed especially by the hymenium. The species differs from the other members of the genus described here not only in color but in the entire absence of stem.

This species which has been collected often by the writer has always been associated with the genus *Helotium* rather than with the one to which it belongs.

CHLOROSPLENIUM ÆRUGINOSUM (Oeder) De Notaris, Comm. Critt. It. 1: 376. 1864.

Plate 24, f. I.

Helvella aeruginosa Oeder, Fl. Dan. pl. 534. 1770.

Peziza aeruginosa Vahl. Fl. Dan. pl. 1200. 1797.

Helotium aeruginosum Fries, Summa Veg. Scand. 355. 1849.

Plants gregarious with a short stem or nearly sessile, concave or nearly plane, bright æruginous-green externally, staining the substratum to some depth the same color; hymenium paler often yellowish; entire plant from 5 to 8 mm. in diameter and the same in height; stem stout, tapering below; asci cylindrical to clavate, 8-spored; spores fusiform or fusoid, 10 to 14 by 3 to 4μ, hyaline; paraphyses slender.

On old wood especially oak, Iowa City, Macbride and Shimek, Mt. Pleasant, Seaver, not uncommon.

The plants of the species are distinguished by the bright æruginous-green color of the exterior of the cups as well as that of the substratum on which they grow. The wood thus stained is made use of in the manufacture of various articles.

CHLOROSPLENIUM VERSIFORME (Pers.) De Notaris, Comm. Critt. It. 1: 376. 1864.

Plate 24, f. II.

Peziza versiforme Pers., Ic. Desc. 25. 1798.

Plants gregarious, stipitate or subsessile, concave or plane, often very irregular in outline, elongated on one side or variously contorted; externally brownish to olivaceous-green; hymenium dull olivaceous-green; asci cylindrical, 8-spored; spores elliptical or subelliptical, 12 to 14 by 3 to 4μ; paraphyses filiform, slender.

On old wood. Decorah, Iowa, E. W. D. Holway.

The only specimens of this species examined from Iowa are those collected by Holway at Decorah.

The color in this form is not nearly so bright as in the preceding and the plants are much more irregular in form. From the original description and illustration the color appears to be quite variable ranging from olivaceous-green to brownish or purplish but never so decidedly green as in *Chlorosplenium aeruginosum* (Oeder) DeNot.

CIBORIA Fuckel, Symb. Myc. 311. 1869.

Cups scattered, firm, often with a long stem, of medium size, waxy, externally smooth, or furfuraceous, hymenium concave or plane; color variable; asci elongated, 8-spored; spores oblong-oval, cylindrical or lanceolate, simple, hyaline; paraphyses present variable.

Plants larger and stem stronger than in the genus *Phialea*. One species reported from the state.

Ciboria sulphurella (Ellis & Everh.) Rehm; Durand, Bull. Torrey Cl. 29: 461. 1902.

Helotium sulphurellum Ellis & Everh., Bull. Torrey Cl. 10: 98. 1883.

Plants gregarious, stipitate; stem variable in length, sometimes as long as 2 cm. and slender, but often very short; cups 2 to 5 mm. in diameter, a little concave or nearly plane; plants very variable in color often sulphur-yellow when fresh with a tinge of green; hymenium darker becoming reddish or reddish-brown, when dry entire plant almost black; asci clavate, 8-spored, 75 by 8μ; spores 1-seriate with the ends overlapped, elliptical, narrowed at the ends, 10 to 12 by 3 to 4μ.

On petioles of ash (*Fraxinus*) Mt. Pleasant, common, Iowa City, Macbride.

The plants of this species were found to be abundant and quite attractive from their variable color. The species has been collected by the writer in New York and North Dakota and probably occurs coextensive with the host.

SCLEROTINIA Fuckel, Symb. Myc., 1: 330. 1869.

Plants for the most part medium large, single or in clusters springing from a sclerotium formed in the stems, leaves or fruits of plants; sclerotium resting over winter; cups at first closed, and globose, becoming expanded and cup-shaped or plane; asci cylindrical to clavate, 8-spored; spores elongated or elliptical, straight or curved, simple, hyaline, 1-seriate.

The genus is distinguished by the sclerotium from which the plants grow. Three species found in Iowa, two of which have their type locality in this state.

KEY TO THE SPECIES.

Sclerotium formed in acorns.	*S. pseudotuberosa.*
Sclerotium formed in seeds of bass wood. . . .	*S. tiliæ.*
Sclerotinum formed in seeds of wild cherry. . .	*S. seaveri.*

Sclerotina pseudotuberosa Rehm, Rabenh. Krypt. Fl. 1^3: 809. 1896.

Ciboria pseudotuberosa Rehm, Ber. Naturh. Ver. Augsburg 26: 28. 1881.

Stromatinia pseudotuberosa Boud., Bull. Soc. Myc. France, 1: 115. 1885.

Hymenoscypha pseudotuberosa Phill., Brit. Discom. 119. 1887.

Plants gregarious, stipitate; stem often 2 cm. long. subflexuose, when dry longitudinally striated. olivaceous to olivaceous-brown; cups at first closed and globose, becoming expanded when moist, 5 to 7 mm. in diameter; hymenium brownish; asci clavate, 8-spored, 120 by 6μ; spores elliptical to ovate, smooth, simple; paraphyses filiform, 3μ in diameter at their apices, hyaline.

On acorns, Decorah.

The only specimens of this species seen were those collected by Mr. E. W. D. Holway in the northeast part of the state.

Sclerotina (*Stromatinia*) tiliæ Reade, Ann. Myc. 6: 114. 1908.

Apothecia mostly solitary, cyathoid, long stipitate, 0.5-1 cm. high, Isabelline color (R), stipe smooth, slender, cylindrical, 0.5 mm. or less thick; disc at first closed then expanded, saucer-shaped, 1 to 3 mm. across, excipulum with pseudoparenchymatous outer layer and a prosenchymatous medulla; asci cylindrical-clavate, 140 to 170 by 8 to 10μ, apex round-truncate, spores blue with iodine, continuous, 9 to 11 by 4 to 5μ; paraphyses scattering, filiform, hyaline.

From sclerotium in seeds of *Tilia americana* L. lying on the ground, Mt. Pleasant, Iowa, April 16, 1906. F. J. Seaver.

The above description is taken from the original without material change, the description having been drawn from Iowa material sent by the writer. The plants in external appearance are very much like those occuring on the seeds of wild cherry described below.

SCLEROTINIA (*Stromatina*) SEAVERI Rehm, Ann. Myc. 3: 519. 1905.

Apothecia 1 or 2 from a single mummy, about 1 cm. high, long stipitate, cyathoid, fawn to Isabella color (R); stipe smooth, slender, cylindrical, more or less tapering and frequently tomentose below, 5 to 20 by 11 mm. without rhizoid-like organs; disc at first closed then expanding saucer shaped, to convex and umbilicate; excipulum with a pseudoparenchymatous outer layer and a prosenchymatous medulla; asci cylindrical-clavate, 155 to 180 by 8 to 11μ, apex round, spores blue with iodine; spores 8, obliquely 1-seriate, ellipsoid, ends rounded, hyaline, continuous, 11 to 17 by 5 to 8μ; paraphyses scattering, filiform, slightly wider at the tips, mostly simple, septate, hyaline.

Chlamydospores (*Monilia seaveri* Reade n. f.) effuse, ash-gray; epiphyllous sometimes later on twigs also, still later in minute cespitulæ on immature fruits citron-shaped, continuous hyaline, 7 to 15 mostly 8 to 10μ, in. long di- and trichotomously branched chains with slender, fusiform disjunctors 3 or 4μ long.

Sclerotia formed in mummified fruits.

Parasitic on leaves, twigs and fruits of *Prunus serotina* Ehrh. growing by roadsides and along fences, Ithaca, N. Y., and Malloryville, N. Y. Apothecia were collected in the latter part of April and the first of May. Chlamydospores were abundant on the leaves during the first part of June and on the fruit in July.

The attention of the writer was first directed to this species by Prof. B. Shimek who collected a number of plants on the seeds of the wild cherry, in March, 1905, in woods near Iowa City. As this was the first occurence of any of the plants of this genus, to my knowledge, in the state it was of more than usual interest. A search was made for more of the material and it was found to be quite common in the early spring so that sufficient material was collected to be issued in exsiccati. Nearly a year later the material was sent to Dr. Rehm of Germany for determination who described it as new.

DASYSCYPHA (Fries) Fuckel. Symb. Myc. 304. 1869.

Dasyscypha (as tribe) Fries, Syst. Myc. 2: 89. 1822.

Cups gregarious, small, distinctly stipitate, expanded, when dry closed, externally clothed with hairs; hymenium concave; asci elongated, 8-spored; spores variable in form, simple, hyaline.

Distinguished from *Trichopeziza* by the stipitate cups.

Two species collected in Iowa.

KEY TO THE SPECIES.

Plants small 1 to 2 mm. in diameter, white. . . .	*D. nivea.*
Plants comparatively large 2 to 5 mm., yellowish. . .	*D. pygmæa.*

DASYSCYPHA NIVEA (Hedw.) Sacc., Syll. Fung. 8: 437. 1889.
Plate 25, f. III.

Octospora nivea Hedw. Obs. Bot. 13. 1802.

Peziza nivea Fries, Syst, Myc. 2: 90. 1822.

Lachnella nivea Phill., Brit. Discom. 245. 1887.

Plants small about 1 mm. in diameter, tapering below into a distinct stem which is sometimes very short or 1 to 2 mm. long, clothed externally with a dense covering of hyaline (white) hairs; hairs enlarged, clavate smooth or minutely roughened; hymenium concave or nearly plane; asci clavate, 8-spored; spores small, simple, hyaline, 7 to 9 by 2μ; paraphyses present.

On decaying wood and herbaceous stems, Iowa City and Mt. Pleasant, common.

In the specimens from which the description is drawn the hairs are decidedly enlarged upwards so as to appear club-shaped and nearly smooth or a little roughened.

DASYSCYPHA PYGMÆA (Fries) Sacc., Syll. Fung. 8: 436. 1889.
Plate 24, f. III.

Peziza pygmea Fries, Syst. Myc. 2: 79. 1822.

Helotium pygmæum Karst., Myc. Fenn. 1: 153. 1871.

Lachnea pygmæa Gill. Discom. 71. 1879.

Lachnella pygmæa Phill., Brit. Discom. 242. 1887.

Plants thickly gregarious, 2 to 3 mm. in diameter with a distinct stem which varies much in length, externally hairy, pale yellowish; stem often branched; hairs not so numerous as in the preceding; asci clavate, 8-spored; spores elliptical or subclavate, hyaline, about 7 to 10 by 2μ paraphyses filiform.

On roots and twigs partially exposed, Iowa City.

The plants were numerous and grew with the stems often to-fully pilose; hymenium concave; asci, 8-spored; spores cylindrical or oblong, simple, hyaline; paraphyses present.

TRICHOPEZIZA Fuckel, Symb. Myc. 195. 1869.

Cups fleshy-coriaceous, for the most part small, only a few mm. in diameter, sessile or subsessile, when dry becoming closed and globose, when moist more or less expanded, externally beautifully pilose; hymenium concave; asci, 8-spored; spores cylindrical or oblong, simple, hyaline; paraphyses present.

KEY TO THE SPECIES.

Hairs hyaline, appearing white to the naked eye.	
On branches of basswood.	*T. tiliæ.*
On decaying oak leaves.	*T. comata.*
Hairs sulphur-yellow becoming brownish when dry.	
Plants occuring on wood, spores 6 to 8μ long. . . .	*T. albo-lutea.*
Plants on herbaceous stems, spores 16 to 20μ long.	*T. sulphurea.*

Trichopeziza tiliæ (Peck) Sacc., Syll. Fung. 8: 428. 1889.

Peziza tiliae Peck, Ann. Rep. N. Y. St. Mus. 24: 96. 1872.

Plate 25, f. i.

Plants gregarious, minute, 1 to 2 mm. in diameter, sessile, concave, closed when dry, expanding when moist, externally densely clothed with hyaline (white) hairs; hairs delicately roughened externally; hymenium pale yellowish or white; asci present but spores not seen.

On dead branches of basswood (*Tilia americana*), Unionville, Iowa.

One collection of the plants of this species has been made in

Iowa by the writer and the plants were found to occur in great abundance in the locality named above. During the season of 1907 the same species was found in abundance on dead branches of basswood along the Red River in North Dakota. It is probably not uncommon where the host occurs.

TRICHOPEZIZA COMATA (Schw.) Sacc., Syll. Fung. 8: 431. 1889. Plate 25, f. II.

Peziza comata Schw., Trans. Am. Phil. Soc. II. 4: 173. 1832.

Plants similar in external appearance to the preceding but smaller scarcely reaching 1 mm. in diameter; hairs tapering to a rather sharp point and covered externally with irregular granules, consisting of elongated interrupted ridges, very different from those of the preceding; asci and spores indistinct.

On decaying oak leaves Iowa City, common.

Well distinguished by the habitat, size of the plants and the peculiar markings of the hairs. In the specimens examined the asci and spores could not be made out and it may be that the plants are immature.

TRICHOPEZIZA SULPHUREA (Pers.) Sacc., Syll. Fung. 8: 401. 1889.

Peziza sulphurea Pers., Tent. Disp. Meth. Fung. 33. 1797.

Lachnum sulphureum Karst., Myc. Fenn. 1: 176. 1871.

Plants small, about 1 mm. in diameter, gregarious, sessile, hemispherical, when dry closed, when moist expanded, clothed externally with a dense covering of delicate hairs which are filled with yellow coloring matter so that the whole plant when fresh has a beautiful sulphur-yellow color, when dry becoming chestnut-brown; hairs variable in length as long as 75μ, smooth below and delicately rough near their apices; asci 65 to 75 by 6μ, 8-spored; spores fusiform, nearly straight or curved, with several oil-drops, 16 to 20 by 2μ; paraphyses 2 to 4μ broad at their apices.

On dead herbaceous stems, Mt. Pleasant, Iowa.

Two collections of this species were made in Mt. Pleasant. The sulphur-yellow color and the habitat are sufficient characters by which the species may be recognized. On microscopic examination the long fusiform spores are characteristic.

TRICHOPEZIZA ALBO-LUTEA (Pers.) Sacc., Syll. Fung. 8: 412. 1889.

Peziza sulphurea albo-lutea Pers., Syn. Fung. 649. 1801.
Helotium albo-luteum Karst., Myc. Fenn. 1: 160. 1871.
Peziza flavo-fuliginea A. & S., Consp. Fung. 319. 1805.
Peziza variecolor Fries, Syst. Myc. 2: 100. 1822.

Plants similar in general appearance to the preceding but larger often 2 mm. in diameter and expanded, when dry becoming closed or partially closed; hymenium smooth, whitish or slightly yellowish, externally clothed with sulphur-yellow hairs which become brown when dry (to the naked eye) slightly rough on the exterior, often a little enlarged at their apices; asci cylindrical to clavate, 8-spored; spores elliptical or slightly clavate, straight or curved, 7 to 8 by 2μ; paraphyses present.

On old wood, Mt. Pleasant, Iowa.

This species was originally described as a variety of the preceding which it resembles in external characters but is very distinct in the size and form of the spores. The plants occur gregarious on old but rather hard wood and this habitat with the generally large size of the plants would enable one to distinguish it from *T. sulphurea* (Pers.) Sacc. which always occurs on herbaceous stems. The color is a very prominent character in both species but the plants when dry change their external appearance from sulphur-yellow to chestnut brown. On microscopic examination the hairs are found to show their original color when moist.

PHIALEA (Pers.) Gill. Discom. 93. 1879.

Phialea (as subgenus) Pers., Myc. Eu. 1: 276. 1822.

Apothecia waxy-membranaceous, at first closed, then spreading, concave or convex, smooth or pruinose, with rather long, slender stem, and even margin (not dentate); asci cylindrical to clavate, 8-spored; spores ovoid, oblong or clavate, simple, hyaline.

Distinguished from *Helotium* by the more slender stem. Two species described from Iowa but probably many more occur.

KEY TO THE SPECIES.

Plants occurring on acorns, hickory-nut husks, etc.,
stem often long. . . . . *P. fructigena.*
Plants on stems of *Polygonum,* stem usually short
1 mm. . . . . *P. scutula fucata.*

PHIALEA FRUCTIGENA (Bull.) Gill., Discom. 99. 1879.
Plate 23, f. 1.

Peziza fructigena Bull. Champ. France. 1: 236. 1809.

Helotium fructigenum Karst., Myc. Fenn. 1: 113. 1871.

Hymenoscypha fructigena Phill. Brit. Discom. 135. 1887.

Hymenoscypha virgultorum fructigenum Rehm, Rabenh. Krypt. Fl. 1^3: 783. 1896.

Plants small, usually 1 to 3 mm. in diameter. at first closed. then opening disc becoming concave or nearly plane, rather pale yellowish, smooth; asci clavate, 8-spored; spores clavate. nearly pointed at the smaller end, guttulate, 14 to 18 by 4 to 5μ; paraphyses filiform. enlarged upwards.

On decaying acorns and husks from hickory-nuts, Iowa City. Plants found to be abundant at times. The stems of the plants of this species are quite variable in length sometimes being nearly 1 cm. while at other times the cups are almost sessile. the length of the stem depending on the conditions as in other stipitate forms.

PHIALEA SCUTULA FUCATA (Phill.) Sacc., Syll. Fung. 8: 266. 1889.

Hymenoscypha scutula fucata Phill., Brit. Discom. 137. 1887.

Plants similar in general appearance to the preceding but smaller scarcely exceeding 1 mm. in diameter with the stem of about the same length; asci clavate, 8-spored; spores clavate, nearly pointed at the narrow end, 18 to 22 by 3 to 4μ; 2- to 3-guttulate, often appearing to be 1-septate.

On dead stems of *Polygonum,* Mt. Pleasant.

Plants are gregarious and occur in large numbers. Similar forms occur on various kinds of herbaceous stems in wet places.

HELOTIUM Fries, Summa Veg. Scand, 354. 1849.

Plants generally gregarious, stipitate or sessile; stem when present short, stout; substance waxy, bright colored; hymenium concave or convex; asci 8-spored; spores elliptical or fusiform, ends blunt or sharp-pointed, simple or occasionally pseudo-septate; paraphyses slender; for the most part small plants growing on wood, stems and leaves.

Several species occur in Iowa, three of which have been studied.

KEY TO THE SPECIES.

Plants more or less stipitate.
  Plants deep lemon yellow; stem very stout, on old wood. . . . . *H. citrinum.*
  Plants pale yellow, stem more slender or wanting, on decaying leaves. . . . . *H. friesii.*
Plants entirely sessile, on dead stems of *Carex*. .*H. citrinulum seaveri.*

*Helotium citrinum (Hedw.) Fries, Summa Veg. Scand. 355. 1849.

Plate 20, f. i.

Octospora citrina Hedw., Laub-Moose 2: 33. 1789.

Helotium friesii (Weinm.) Sacc., Syll. Fungi 8: 228. 1889.

Plate 23, f. ii.

Peziza friesii Weinm., Hymeno-Gastero-Mycetes 469. 1836.

Plants 1 to 2 mm. in diameter, usually with a short stem but often nearly sessile; hymenium plane or convex, pale yellow, when dry rather deep yellow, color resembling that of the preceding but much paler; asci clavate, 65 to 70 by 5 to 6μ, 8-spored; spores slightly clavate, 8 to 9 by 3 to 4μ; paraphyses filiform, slender.

On decaying leaves of *Populus* sp. in damp place in woods, Iowa City.

The plants described here under this name were abundant on the substratum named above, and while the microscopic characters of the species under which this is here described are not mentioned in the original description, the plants correspond well in external characters.

HELOTIUM CITRINULUM SEAVERI Rehm, Ann. Myc. 4: 67. 1906.

Apothecia scattered, sessile, at first globose, becoming spread out and patellate in form, disc orbicular; hymenium lemon-yellow, .5 to 4 mm. in diameter, externally smooth, whitish; excipulum prosenchymatous; margin undulate, when dry, hymenium orange-yellow; asci clavate, apex rotundate, 40 to 45 by 5 to 7μ, 8-spored; spores fusiform, straight or slightly curved, simple, hyaline, 7 to 10 by 1.5μ, 2-seriate; paraphyses filiform, hyaline, 1μ in diameter.

On dead stems of *Carex* sp., hillsides, Iowa City, Iowa, May, 1905.

Two collections of this material were made at Iowa City in localities about two miles apart. The material was collected in quantity sufficient for distribution in exsiccati. In color the plants resemble those of *Helotium citrinum* but the plants are very different in other characters. The stem is entirely wanting and the discs are spread out so that the hymenium is entirely plane. Compare *H. flexuosum* Massee.

GORGONICEPS Karst., Myc. Fenn. 1: 15. 1871.

Apothecia sessile or substipitate, obconic or elongated, finally expanded, soft, almost gelatinous, excipulum composed of brown filaments; asci clavate; spores crowded together, fasciculate, rod-like, or filiform, hyaline, many-septate or guttulate; paraphyses filiform.

At least one species rather common on rotten wood.

GORGONICEPS IOWENSIS Rehm, Ann. Myc. 4: 338. 1906.
Plate 26, f. II.

Apothecia scattered, sessile, subglobose, tapering below into a stem-like base; margin becoming convex and immarginate, whitish, externally smooth, slightly greenish or bluish-green, .2 to .5 mm. in diameter and high, when dry brownish; asci clavate, apex rotundate, 80 to 100 by 10 to 12μ, 8-spored; spores subcylindrical, a little curved or almost straight, about 7-septate, scarcely constricted; hyaline, 30 to 33 by 3 to 4μ; paraphyses filiform, 3μ thick, apices 2.5 to 3μ, hyaline.

On decaying wood, Mt. Pleasant.

One collection of this material was made in which the bluish-green color of the plants seemed to be a conspicuous character. Whether this is constant or not we cannot say.

The specimen described in the Discomycetes of Eastern Iowa and doubtfully referred to *Patellaria melaxantha* (Fries) Phillips is a *Gorgoniceps* the genus differing from *Patellaria* in the soft, waxy consistency of the plants. This specimen differs from the above mainly in the color of the plants which is yellowish to brown, and the plants were often found to be confluent. There also seems to be a difference in the size of the spores but as the original material is not at hand a more careful comparison cannot be made at present. Unless field study shows these differences to be constant it is thought best to refer this material all to the above name. The following is the description which was drawn from fresh material.

Plants minute, not more than 1 mm. in diameter, generally less, gregarious, or often confluent, depressed, yellowish-brown, darker externally near the base; hymenium concave, plane or slightly convex, more or less papillate or rough; asci clavate, 12 to 14 by 100 to 110μ, very slender at the base, apex rounded, attenuated; spores 8, fusiform, generally curved, 5- to 7-septate, hyaline, 35 to 40 by 3 to 4μ, obliquely arranged in the ascus, more or less twisted around each other; paraphyses filiform, branched.

On decaying wood, Iowa City.

The plants described here have been collected several times in the summer and fall. They are minute in size but always gregarious and often form a confluent yellowish mass. The internal characters are quite distinct. Spores are fusiform, generally curved or double-curved, becoming very slightly S-shaped, from 5- to 7-septate, (generally 7) and often apparently constricted at the septa. Paraphyses are less distinct but filiform and branched.

Also a third collection of *Gorgoniceps* was made at Mt. Pleasant on old wood of *Platanus occidentalis*. This species is undoubtedly the same as the one collected at Iowa City although the plants are rather smaller and do not show the same tendency to become confluent. The plants are very numerous but small and on account of their dull color not easily seen. In spite of the slight differences we feel safe in saying that this is the same species collected at Iowa City but whether these are both the same as that describd as *Gorgoniceps iowensis* Rehm we are uncertain.

These specimens are close to *Gorgoniceps pumilionis* Rehm.

CORYNE Tul., Carp. 3: 190. 1865.

Plants tufted, with a short, thick stem, externally smooth; substance gelatinous, hard when dry; hymenium at first concave, becoming nearly plane, generally dark-colored; asci cylindrical, 8-spored; spores fusiform, at last 2- to 8-celled, generally in two rows; paraphyses slender, enlarged upwards; plants usually occurring on decaying wood.

Two forms occur in the state.

KEY TO THE SPECIES.

Plants small, usually not to exceed 1 cm. in diameter, spores 20μ.	*C. sarcoides.*
Plants large often 2 to 3 cm., spores large, 25 to 30μ.	*C. urnalis.*

*CORYNE SARCOIDES (Jacq.) Tul., Carpol. 3: 190. 1865.
Plate 26, f I.

Lichen sarcoides Jacq., Misc. Aust., 2: 378. 1781.

Peziza sarcoides Pers., Syn. Fung., 633. 1801.

Bulgaria sarcoides Fries, Syst. Myc., 2: 168. 1822.

Ombrophila sarcoides Karst., Myc. Fenn., 1: 86. 1871.

CORYNE URNALIS (Nyl.) Sacc., Fungi Ven., IV., 31.

Bulgaria urnalis Nyl., Obs. Pez. Fenn. 73. 1868.

Sarcoidea sarcoides urnalis Karst., Myc. Fenn., 1: 87. 1871.

Coryne purpurea Fuckel, Symb. Myc., 284. 1869.

Ombrophila purpurea Phill., Brit. Discom., 324. 1887.

The characters of this species are identical with those of the preceding except the size of the plants and spores. The spores are mostly 25 to 30μ long, and the plants are often 2 to 3 cm. in diameter.

Plants collected at Mt. Pleasant in woods along the Skunk River.

In the study of the preceding species no trace could be made out of the septa of the spores notwithstanding the fact that this is one of the characteristics of this genus. But in the last named species the septa could be quite easily seen although they are very narrow and delicate and for this reason may be overlooked. The septa are more or less irregular not always extending straight across the spore.

FAMILY 8. MOLLISIACEÆ.

Plants either superficial or erumpent-superficial, mostly sessile on the substratum; substance fleshy, soft, composed of roundish dark cells; cups at first closed gradually spreading; asci 8-spored, opening with a pore; spores hyaline, 1- to many-septate.

MOLLISIA (Fries) Karsten, Myc. Fenn. 1: 187. 1871.

Mollisia Fries (as subgenus) Syst. Myc. 2: 137. 1822.

Plants small, sessile. at first globose, becoming expanded; apothecium soft, waxy; asci cylindrical, 8-spored; spores elliptical to fusiform, simple, straight or curved.

The genus is distinguished by the small size of the plants and the soft consistency of the apothecium as well as by the microscopic characters of its component cells. Four species collected but others probably occur.

KEY TO THE SPECIES.

Plants parasitic on leaves and stems of *Potentilla*. . .	*M. dehnii.*
Plants saprophytic on wood and stems of herbaceous plants.	
Plants occurring on dead wood, cinereous. . . .	*M. cinerea.*
Plants occurring on herbaceous stems.	
On stems of Polygonum.	*M. polygoni.*
On dead stems of *Ambrosia* etc.	*M. atrata.*

*MOLLISIA DEHNII (Rabenh.) Karst., Myc. Fenn. 1: 206. 1871.
Plate 35, f. I.

Peziza dehnii Rabenh., Bot. Zeit. 1: 11-12. 1843.

This is a common species and known by its parasitic habits. The species appears to have a wide distribution, specimens having been collected by the writer in New York, North Dakota as well as in Iowa. The plants grow in such numbers as to almost completely cover the stems and leaves of the host.

MOLLISIA CINEREA (Batsch) Karst., Myc. Fenn. 1: 189. 1871.

Peziza cinerea Batsch, Elench. Fung. 2: 198. 1786.

Niptera cinerea Fuckel, Symb. Myc. 292. 1869.

Plants gregarious or scattered, at first globose becoming expanded, cinereous or sublivid, margin often elevated, whitish, undulated or wavy, .5 to 2 mm. in diameter; asci cylindrical to clavate, 45 to 70 by 5 to 6μ; paraphyses filiform scarcely enlarged at their apices.

On decaying wood of various kinds, common.

*MOLLISIA POLYGONI (Lasch.) Gill., Discom. 120. 1879.
Plate 35, f. II.

Peziza polygoni Lasch., Rabenh. Herb. Myc. 1127.

Niptera polygoni Rehm, Ber. Naturh. Ver. Augsburg 26: 21. 1881.

Peziza luctuosa Cooke, Hedwigia 14: 83. 1875.

MOLLISIA ATRATA (Pers.) Karst., Myc. Fenn. 1: 200. 1871.

Peziza atrata Pers. Syn. Fung. 669. 1801.

Pyrenopeziza atrata Fuckel, Symb. Myc. 294. 1869.

Plants gregarious, at first globose, becoming expanded, .5 to 1 mm. in diameter, externally blackish, hymenium concave, yellowish to cinereous or quite black; asci cylindrical to clavate, 25 by 5 to 6μ; spores elongated elliptical 5 to 6 by 2μ; paraphyses very slender.

On dead stems of *Ambrosia trifida*.

As stated in previous reports the plants referred to this name here are larger than is usually indicated for this species but in other respects seem to conform well.

There seems to be some difference of opinion as to what the real *Peziza atrata* Persoon was, the species having been originally reported on wood, which at the present time is known only on herbaceous stems. While the same species do often occur on wood and herbaceous stems this difference here suggests a possibility that the species has been misinterpreted.

ORBILIA Fries, Summa Veg. Scand. 357. 1849.

Plants orbicular, waxy-membranaceous, patellate, margin often undulated, when dry horny; asci clavate, 8-spored; spores minute, straight or curved, slender.

The plants of this genus occur commonly on rotten wood and bark and are characterized by the small, delicate, membranaceous discs which vary in color from nearly white to deep flesh-red. Two forms reported here which are very distinct, probably many others occur.

KEY TO THE SPECIES.

Plants deep flesh-red.	*O. vinosa.*
Plants pale yellowish.	*O. chrysocoma.*

ORBILIA VINOSA (A. & S.) Karst. Myc. Fenn. 1: 101. 1871.

Peziza vinosa (A. & S.) Consp., Fung. 308. 1805.

Calloria vinosa Fries, Summa. Veg. Scand. 359. 1849.

Plants thickly gregarious, often confluent, patellate with the hymenium nearly plane when occurring singly or very irregular when confluent, thin membranaceous, becoming horny when dry, bright flesh-red when fresh, fading somewhat when preserved for long periods, 1 to 2 mm. in diameter, margin even when young becoming undulate with age; asci clavate, 35 by 4 to 5μ, 8-spored; spores very slender, straight or curved, about 10 to 15 by 1.5μ; paraphyses present.

On rotten wood, Mt. Pleasant.

Plants distinguished externally by the bright, flesh-red color and microscopically by the character of the spores. The species was collected in quantity.

ORBILIA CHRYSOCOMA (Bull.) Sacc., Syll. Fung. 8: 624. 1889

Peziza chrysocoma Bull., Champ. France. 254. 1809.

Calloria chrysocoma Fries, Summa Veg. Scand. 359. 1849.

Plants sessile, at first closed becoming expanded, scattered or crowded and often confluent, .5 to 1 mm. in diameter, golden-yellow, thin and membranaceous; asci and spores as in the preceding.

The plants are very similar in every respect to the preceding except that the color is golden-yellow instead of flesh-red as in that species. The spores of the two species are so minute that they are studied with difficulty.

FAMILY 9. PATELLARIACEÆ.

Plants either superficial on the surface of the substratum or at first immersed becoming erumpent, for the most part leathery or hard, dark colored, black, hemispherical or hysteriform, then expanded becoming elliptical or circular in outline; asci 8- to many-spored; spores globose, elliptical or elongated and filiform, 1- to many-septate, hyaline or colored.

The plants of this family are dark in color resembling in this respect those of the Pyrenomycetes. The family also grades into the lichens so that it is difficult to draw any fast line between the two groups.

PATELLARIA Fries. Syst. Orbis. Veg. 113. 1825.

Apothecia for the most part, sessile, and never immersed, black, often bluish with transmitted light, rounded, or linear; asci clavate, thick-walled, 4- to 8-spored; spores fusoid, often larger at one end becoming clavate, straight or bent 3- to many-septate, 2-seriate, hyaline; paraphyses branched, forming an epithecium.

When the genus *Patellaria* was established by Fries *Patellaria atrata* (Hedw.) was designated as the type of the genus, the species being a hyaline-spored form, but notwithstanding this fact that species has been taken out of this genus and placed in the genus *Lecanidion* by recent writers. The genus *Patellaria* as treated by Saccardo in Syll. Fung. is represented by the colored-spored forms. If the genus as founded by Fries is valid it should contain the hyaline-spored species and the brown-spored forms should be placed in the genus *Mycolecidea* founded by Karst.

Two species; one very common in the state.

KEY TO THE SPECIES.

Asci 8-spored.	*P. atrata.*
Asci 4-spored.	*P. tetraspora.*

PATELLARIA ATRATA (Hedw.) Fries, Syst. Orbis. Veg. 113. 1825.

Lichen atratus Hedw., Laub-Moose 2: 73. 1789.

Peziza patellaria Pers., Syn. Fung. 670. 1801.

Lecanidion atratum Rabenh., Krypt Fl. 1: 342. 1844.

Plants small, 1 to 2 mm. in diameter, sessile, patelliform with the margin elevated, black (bluish with transmitted light); hymenium plane, of the same color; asci clavate, 8-spored; spores fusoid to clavate, 5 to 7-septate, hyaline 35 to 50 by 6 to 7μ; paraphyses filiform, branched, ends enlarged forming an epithecium.

On various kinds of dead wood, *Carpinus, Celtis, Carya, Juglans, Populus, Quercus, Salix, Viburnum, Vitis, Ulmus* and on herbaceous stems, common.

PATELLARIA TETRASPORA Massee & Morgan; Morgan, Jour. Myc. 8: 180. 1902.

Plate 36, f. III.

Lecanidion tetraspora Seaver, Proc. Iowa Acad. Sci. 12: 118. 1905.

This species is similar in every way to the preceding with the exception of the asci and spores. The asci are 8-spored and naturally a little narrow and the spores are somewhat larger.

This might seem to be only a variety of the preceding but careful study of the plants of the species which have been collected several times in Iowa seems to show the 4-spored character to be constant. In none of the plants were both 4-spored and 8-spored asci found but they were always either 4 or 8-spored. The plants containing 8-spored asci show the asci to be broader and clavate while those containing 4-spored asci show them to be more nearly cylindrical and much narrower as would follow from the smaller number of spores contained.

KARSCHIA Koerber, Parerga Lich. 459. 1865.

External characteristics the same as those of the genus *Patel-*

laria from which the plants can be distinguished only on microscopic characters; asci clavate, 8-spored; spores elliptical to fusoid, 1-septate, becoming brown.

One species of the genus found to be very common in Iowa.

KARSCHIA TAVELIANA Rehm, Rabenh. Krypt. Fl. 1^3: 1223. 1896.
Plate 36, f. I.

Plants scattered or closely crowded, at first concave, becoming plane with the margin often slightly elevated, black, rounded in form or when crowded becoming irregular often in dense masses; asci clavate, 8-spored; spores irregularly crowded, elliptical or with ends slightly narrowed, 1-septate, brown, often a little curved; 14 to 18 by 4μ; paraphyses a little enlarged upward and forming an epithecium.

On old wood especially butternut (*Juglans*), Iowa City and Mt. Pleasant.

This species has been listed in previous reports as *Karschia lignyota* but according to Dr. Rehm it is distinct from that species although apparently close to it. The plants have been found to be very common in Iowa on partially decayed wood but seem to show a decided preference for butternut.

MYCOLECIDEA Karst., Medd. Soc. Fauna Fl. Fenn. 16: 27. 1888.

External characteristics the same as those of the genus *Patellaria;* asci clavate, 8-spored; spores 3 to many-septate, brown; paraphyses branched and enlarged upwards forming an epithecium, brownish.

One species collected in Iowa which is the type of the genus as founded by Karsten.

MYCOLECIDEA TRISEPTATA Karst., Medd. Soc. Fauna Fl. Fenn. 16: 27. 1888.
Plate 40, f. I.

Patellaria triseptata Sacc., Syll. Fung. 8: 787. 1889.

Leciographa triseptata Morgan, Jour. Myc. 8: 180. 1902.

Plants scattered, superficial, patellate, .5 to 1 mm. in diameter;

hymenium at first concave, becoming plane with the margin often a little elevated; asci clavate, 8-spored; spores crowded in the ascus, elliptical, a little curved, 3-septate, at first hyaline becoming pale brown, 15 to 20 by 5μ, slightly constricted at the septa; paraphyses filiform, thickened above and forming a brown epithecium.

On old wood of oak, Mt. Pleasant.

The plants are very similar in general appearance to those of *Patellaria atrata* (Hedw.) Fries but appear brown with transmitted light rather than bluish as in that species. Also the spores are very different being much smaller and brown. One collection of the species was made but in considerable quantity.

HYSTEROPATELLA Rehm, Rabenh. Krypt. Fl. 1^3: 367. 1896.

Apothecia at first buried becoming erumpent, sessile, linear, straight or bent, simple or branched, later elliptical or roundish, often becoming patelliform, black; asci ovate or very broad, 8-spored; spores elongated, straight or curved, usually 4-celled, at first hyaline, becoming brownish.

The plants of this genus stand intermediate between those of the *Hysterineæ* on the one side and the *Patellariaceæ* on the other. They are at first hysteriform the lips expanding until they become boat-shaped and under favorable conditions of moisture entirely patelliform at least in some of the species included here with this genus.

KEY TO THE SPECIES.

Spores elliptical.
    Spores about 15 by 4μ. . . . . *H. prostii.*
    Spores about 23 by 8μ. . . . . *H. elliptica.*
Spores clavate. . . . . *H. clavispora.*

HYSTEROPATELLA PROSTII (Duby) Rehm. Rabenh. Krypt. Fl. 1^3: 367. 1896.

Hysterium prostii Duby. Bot. Gall. ed. 2. 719. 1830.

Plants gregarious or scattered, at first hysteriform, .5 to 1 mm. in length, lips soon spreading becoming boat-shaped, especially when moist; asci broad, ovate, 8-spored, about 50 by 10μ; spores slightly curved, pale brownish when mature, 3-septate, elliptical, 15 by 4μ.

On bark of *Ulmus,* Iowa City and Mt. Pleasant, rather common. The species has also been observed and studied in North Dakota and probably has a wide distribution.

HYSTEROPATELLA ELLIPTICA (Fries) Rehm, Rabenh, Krypt. Fl. 1^3: 368. 1896.

Hysterium ellipticum Fries, Obs. Myc. 1: 195. 1815.

Plants gregarious or often crowded in little clusters bursting through the epidermis, similar in general appearance to the preceding but a little larger; asci clavate, 8-spored; spores elliptical, at first hyaline, becoming pale brown, 3-septate, 23 by 8μ.

On bark (*Pyrus*) Mt. Pleasant.

The plants are quite similar in external appearance to the preceding but show a marked difference in the size of the spores. The plants from which the description has been drawn have been examined by Dr. Rehm and referred to this species.

HYSTEROPATELLA CLAVISPORA (Peck) comb. nov.
Plate 36, f. II.

Tryblidium clavisporum Peck, Ann Rep. N. Y. St. Mus. 35: 143. 1883.

Patellaria clavispora Sacc., Syll. Fung. 8: 787. 1889.

Leciographa clavispora Morgan, Jour. Myc. 8: 180. 1902.

Plants gregarious, at first immersed becoming erumpent, hysteriform with the lips gradually spreading becoming boat-shaped and under favorable conditions of moisture the plants become entirely rounded and patelliform, black; asci broad-clavate, continued below into a stem-like base, 75 by 15 to 18μ, 8-spored; spores 2-seriate or irregularly crowded, at first hyaline, becoming yellowish finally pale brown, 3 to 5-septate (rarely 5), clavate with the narrow end below, with an oil-drop in each cell, 25 to 30 by 8 to 9μ; paraphyses forming a black epithecium.

On bark of willow also on decorticated wood of willow (*Salix*) and cottonwood (*Populus*), Iowa City and Mt. Pleasant, common.

The plants of this species have been collected and studied by the writer for several years and so far have been found only on the two hosts named above. They are most common on the inside of dead, loose bark of willow where they occur often in great abundance. The inner bark of a dead willow in Mt. Pleasant was found to be entirely covered with these plants. Specimens which had fallen in a damp place showed the apothecia to be expanded and entirely circular in form while younger specimens of those in drier conditions were hysteriform with the lips more or less spreading.

In the judgment of the writer, this would seem to be a typical representative of the genus *Hysteropatella* as established by Rehm and for this reason I have ventured to make the combination.

Specimens from the herbarium of the writer have been examined by Mr. Peck and the identification reported to be correct. This is a fine species very distinct in the decidedly clavate pale brown spores, entirely different from *Patellaria clavispora* Berk & Br.

BLITRYDIUM DeNotaris, Comm. Critt. It. 1: 374. 1863.

Apothecia fleshy-coriaceous, at first buried, becoming erumpent, opening irregularly finally becoming patelliform; asci clavate, 4 to 8-spored; spores elliptical or elongated, becoming muriform, at first hyaline, becoming pale yellowish-brown.

One species found in Iowa.

BLITRYDIUM FENESTRATUM (Cooke & Peck) Sacc., Syll. Fung. 8: 805. 1889.

Plate 40, f. II.

Patellaria fenestrata Cooke & Peck; Peck Ann. Rep. N. Y. St. Mus. 28: 68. 1879.

Plants at first immersed springing through the outer bark singly or in small groups, at first linear or triangular or more or less star-shaped, lips expanding gradually becoming patellate and at last entirely circular in outline; hymenium plane with the margin elevated, black, appearing rough; asci very broad-clavate, with a long stem-like base, 8-spored, 125 by 25μ; spores very large, clavate, at first hyaline, then yellowish-brown about 10 to

12-septate and muriform with an oil-drop in each cell, 45 to 50 by 15 to 18μ; paraphyses forming an epithecium.

On dead branches of *Populus tremuloides*, Decorah.

The only Iowa material of this species seen was that collected by Mr. Holway but the species has been found by the writer to be very common in North Dakota on dead branches of the above host in aspen timber near Fargo.

FAMILY 10. CENANGIACEÆ.

Plants at first immersed, becoming erumpent for the most part dark colored, at first closed later opening and concave to plane; asci mostly 8-spored; spores elongated to filiform, 1 to many-celled, often muriform, hyaline to brown; paraphyses branched forming an epithecium.

CENANGIUM Fries, Syst. Myc. 2: 177. 1822.

Cups scattered or tufted at first immersed, then breaking through the substratum, sessile, leathery or waxy, brown or blackish; receptacle cup-shaped or nearly plane; asci clavate, 8-spored, elongate, cylindrical or tapering at the ends; spores simple, hyaline; paraphyses enlarged at their apices, forming an epithecium.

Two species collected in the state.

KEY TO THE SPECIES.

Plants sessile, deep, cup-shaped. . . . . *C. populneum.*
Plants short stipitate, hymenium nearly plane. . . *C. rubiginosum.*

*CENANGIUM POPULNEUM (Pers.) Rehm, Rabenh. Krypt. Fl. 13: 220. 1896.

Plate 39, f. I.

Peziza populnea Pers., Tent. Disp. Meth. Fung. 35. 1797.

Peziza fascicularis A. & S., Conspect. Fung., 315. 1805.

Dermatea fascicularis Fries, Summa. Veg. Scand., 362. 1849.

Encoelia fascicularis Karst., Myc. Fenn. 1: 217. 1871.

Cenangium fascicularie Karst., Act. Soc. Fauna Fl. Fenn. 2: 145. 1885.

CENANGIUM RUBIGINOSUM (Fries) Sacc., Syll. Fung. 8: 569. 1889.

Plate 38, f. II.

Peziza rubiginosa Fries, Elench. Fung 2: 7. 1828.

Plants springing singly or in clusters of 2 to 4 from beneath the bark tapering below into a short stem-like base; hymenium concave, becoming nearly plane; plants about 2 mm. in diameter, externally reddish-brown and rough, more or less wrinkled; hymenium darker, nearly black or purplish; asci clavate, 8-spored, 125 by 15μ, spores 1-seriate or slightly crowded near the apex of the ascus, elliptical to fusoid, mostly narrower toward the lower end, pyriform, and unsymmetrical, 17 by 7 to 8μ; paraphyses numerous, a little enlarged upwards.

On dead limbs of *Carpinus caroliniana*, Decorah, Iowa, E. W. D. Holway, also reported from London, Canada, and South Carolina.

The material collected in Iowa is distributed in Ellis, North Am. Fungi, 992.

According to Saccardo *Cenangium rubiginosum* Cooke in Ravenel, Fungi. Am. Exsicc 635 is different.

While this species seems to have been collected in several localities there is little mention of it in the literature of N. Am. Fungi.

DERMATEA Fries, Summa Veg. Scand. 362. 1849.

Apothecia erumpent-superficial, often cespitose at the base, and with a more or less well developed stroma; hymenium concave or plane; asci cylindrical to clavate, 8-spored; spores elliptical or elongated, simple, hyaline.

The genus is close to *Cenangium*. One species which has been described from Iowa material.

DERMATEA OLIVASCENS Rehm, Ann. Myc. 5: 80. 1907.

Plate 38, f. I.

Apothecia scattered and occuring singly or in small clusters at first immersed, becoming erumpent, subglobose becoming patelliform with the hymenium plane or convex, olive-brown, pruinose, .5 to 1.5 mm. in diameter with a short stem; asci clavate, 150 by 20 to 25μ, 8-spored; spores elliptical, simple, 20 to 25 by 10 to 12μ. 2-seriate with conspicuous oil drops; paraphyses 2μ in diameter.

On (dead?) branches of *Cratægus* sp. Mt. Pleasant.

The plants from which this species was described were collected during the winter on branches of *Cratægus* near Mt. Pleasant, where they occurred in abundance.

According to Dr. Rehm the species is distinct from *Dermatea cratoegicola* Durand in which the spores are 35 to 50 by 15 to 17μ. There is also some difference in the color of the plants in the two species. The asci appear to be filled with large, irregular oil drope, which are so conspicuous that it is with difficulty that the outline of the spores may be seen, but a faint outline can be detected. The spores when removed from the asci are often seen to contain 1 or more of these drops.

TYMPANIS Tode, Fungi Meckl. 1: 24. 1790.

Plants erumpent, single or in dense clusters, at first globose, closed, becoming expanded, for the most part with short, thick stem; asci thick-walled, 8-spored, spores producing numerous minute bodies which fill the ascus.

One species collected in the state.

TYMPANIS CONSPERSA Fries, Syst. Myc. 2: 175. 1822.

Plants springing in minute dense clusters through the outer bark of the host, at first globose, becoming expanded, black; asci clavate, thick-walled, filled with granular material; spores not well developed; paraphyses branched, enlarged upwards.

On bark of *Populus* sp. Iowa City.

Dead branches of the host were thickly covered with the plants of this species which resemble those of the genus *Dermatea* externally. The asci are well developed but the spores are indistinct or not well developed.

SARCOSOMA Caspary; Rehm, Rabenh. Krypt. Fl 1^3: 497. 1896.

Plants globose to ovate or cylindrical, sessile or stipitate, externally dark colored, brown or blackish; tissue gelatinous; asci cylindrical, 8-spored; spores hyaline, simple, elliptical.

Distinguished mainly by the hyaline spores. One species rather common in Iowa.

*SARCOSOMA RUFA (Schw.) Rehm, Rabenh. Krypt. Fl. 1^3: 497. 1896.

Plate 37, f. I.

Bulgaria rufa Schw., Trans. Am. Phil. Soc. II. 4: 178. 1832.

BULGARIA Fries, Syst. Myc., 2: 166. 1821.

Cups gregarious with a short, thick stem; forming at first under the bark, later breaking through; externally dark colored, rough, often with short hairs, gelatinous, shrinking much when dried; asci cylindrical, generally 8-spored; spores elliptical, or unequal-sided, simple, hyaline, then brown; paraphyses forming a colored epithecium; plants large, growing on wood.

One species common about Iowa City.

*BULGARIA INQUINANS (Pers.) Fries, Syst. Myc. 2: 167. 1823.

Plate 37, f. II.

Peziza polymorpha Oeder, Fl. Dan. pl. 464. 1769.

Peziza nigra Bull., Herb. France, pl. 116. 1782.

Peziza inquinans Pers., Syn. Fung. 631. 1801.

HOLWAYA Sacc., Syll. Fung. 8: 646. 1889.

Plants stipitate; stem more or less tomentose; entire plant dark brown; hymenium plane or convex; asci clavate, 8-spored; spores elongated approaching filiform, many-septate.

One species occurs in Iowa, which is the only representative of the genus.

HOLWAYA GIGANTEA (Peck) Durand, Bull. Torrey Cl. 28: 354. 1901.

Plate 38, f. II.

Stilbum giganteum Peck, Ann. Rep. N. Y. St. Mus. 24: 93. 1871.

Bulgaria ophiobolus Ellis. Am. Nat. 17: 193. 1883.

Graphium giganteum Sacc., Syll. Fung. 4: 611. 1886.

Holwaya ophiobolus Sacc., Syll. Fung. 8: 646. 1889.

Plants occurring singly or in cespitose clusters, stipitate; hymenium concave, becoming plane or convex about 1 cm. in diameter, dark-colored, brownish-black; asci clavate, 8-spored; spores in a fascicle in the ascus, very long, more or less tapering toward the end, many-septate, about 65 by 3 to 4μ, paraphyses filiform, slender and enlarged at their apices.

On partially decayed wood, Decorah.

The only specimens of this species examined are those collected by Mr. Holway in the northeast part of the state. The plants are very distinct in the long filiform, many-septate spores.

URNULA Fries, Summa Veg. Scand. 364. 1849.

Cups stipitate, urn-shaped, at first closed, then opening by a circular or stellate aperture, externally dark colored, furfuraceous or clothed with dark colored, minute hairs; asci cylindrical, 8-spored; spores oblong-elliptical.

One species is common in woods in the early spring.

URNULA CRATERIUM (Schw.) Fries, Summa Veg. Scand. 364. 1849.

Plate 39, f. II.

Peziza craterium Schw., Schr. Nat. Ges. Leipzig 1: 117. 1822.

Cenangium craterium (Schw.) Fries, Elench. Fung. 2: 21. 1828.

Dermea craterium Schw., Trans. Am. Phil. Soc. II. 4: 237. 1832.

Geopyxis craterium (Schw.) Rehm, Rabenh. Krypt. Fl. 1^3: 974. 1896.

Cups large, long stipitate, subcespitose, dark brownish-black, at first closed, hollow within, opening at the top by an irregular rupture, leaving the margin notched, involute, clothed externally with minute black hairs; asci very long, cylindrical, 8-spored; spores oblong, hyaline, granular within, 25 to 30 by 10μ; paraphyses slender, septate.

On half-buried branches and sticks in woods, Iowa City and Mt. Pleasant.

A large species very common on decaying sticks in woods in the spring. A number of the plants may often be found attached to a small stick standing upright in a row. They are at first club-shaped, black structures, hollow in the center, finally opening by a star-shaped aperture at the apex, when mature leaving the margin notched. In Engler-Prantl Natülichen Pflanzenfamilien this species is included with the subgenus *Geopyxis* and there seems to be some difference of opinion as to whether this plant should be included with that subgenus, which is now treated as a genus, or allowed to remain where it is.*

ORDER III. PHACIDIINEÆ.

Apothecia free on the substratum or forming a stroma, at first immersed, becoming erumpent, roundish or elongated.

FAMILY 11. STICTIDACEÆ.

Apothecia bright-colored, never black, surrounded by the rough edges of the broken epidermis.

PROPOLIS Fries, Syst. Myc. 2: 198. 1822.

Apothecia at first immersed, becoming erumpent, surrounded by the rough edges of the broken epidermis; asci 8-spored; spores elliptical, simple, hyaline, usually with 2 oil-drops, 2-seriate, straight or curved.

But one species of the genus and order can be reported on at this time.

PROPOLIS FAGINEA (Schrad.) Karst., Myc. Fenn. 1: 244. 1871.
Plate 40, f. II.

Hysterium fagineum Schrad., Jour. Bot. 2: 68. 1799.

Stictis versicolor Fries., Syst. Myc. 2: 198. 1822.

Propolis versicolor Fries, Summa Veg. Scand. 372. 1849.

Plants at first immersed, becoming erumpent, usually elongated but often rounded; margin laciniate; hymenium farinose, white or whitish, plane or a little convex especially when moist; asci broadly clavate, 8-spored; spores oblong, rounded at the ends, slightly curved with (usually) 2 oil-drops, large, 24 to 30 by 7 to 9μ; paraphyses present, slender.

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*Bull. Torrey Cl. 29: 137.

On wood of various kinds, Mt. Pleasant, common.

The plants are quite easily recognized by the elongated white patches on the surface of old pieces of wood and logs, the white patches which are often several millimeters in length being surrounded by the rough torn edges of the broken epidermis. This is a variable species and a long list of synonyms might be given. It has been collected by the writer at Mt. Pleasant on the following kinds of wood; *Platanus occidentalis, Vitis vulpina,* and *Carpinus caroliniana.*

The species has also been collected by the writer in New York and North Dakota and probably has a wide distribution.

ORDER IV. HYSTERIINEÆ.

Apothecia at first immersed or always free on the substratum, more or less elongated, simple or occasionally branched, opening with a longitudinal cleft; asci 8-spored; paraphyses present, slender.

FAMILY 12. HYSTERIACEÆ.

Apothecia free on the substratum, elongated, straight or bent, occasionally branched, opening with a longitudinal cleft; asci 8-spored, spores variable.

HYSTERIUM Tode, Fungi Meckl. 2: 3. 1791.

Apothecia superficial or erumpent becoming superficial, oblong or elliptical, carbonaceous or subcarbonaceous, opening with a longitudinal cleft; asci clavate or cylindrical, mostly 8-spored; spores elliptical, straight or curved, 2 to many-septate, brown.

One species of the genus reported here.

Hysterium pulicare Pers., Syn. Fung. 98. 1801.

Hysterographium pulicare Corda, Ic. Fung. 5: 77. 1842.

Apothecia scattered or gregarious, superficial, variable in form, oblong or elliptical, longitudinally striated, black, lips slightly opening, about 1 mm. long and half as broad; asci clavate, 8-spored; spores partially 2-seriate, straight or slightly curved, 3-septate, scarcely constricted, 20 to 25 by 8μ.

On bark of wild cherry (*Prunus* sp.)

The spores of this genus are similar to those of the genus *Hysteropatella* but the plants differ in that the lips do not expand as in that genus or, if at all, only slightly.

GLONIUM Muehl; Schw. Schr. Nat. Ges. Leipzig 1: 50. 1822.

Plants erumpent, linear, elongated, sometimes radiately arranged, carbonaceous or tough-membranaceous, opening by a longitudinal cleft; asci cylindrical to clavate, 8-spored; spores 1-septate, hyaline.

Distinguished by the hyaline, 1-septate spores. Two species common.

KEY TO THE SPECIES.

Plants radiately arranged.	*G. stellatum.*
Plants lying parallel with each other.	*G. parvulum.*

GLONIUM STELLATUM Schw., Schr. Nat. Ges. Leipzig 1: 50. 1822.

Subiculum effused, brownish-black, often covering considerable area (2 or more cm.) composed of slender, branching, interwoven hyphæ; apothecia seated on the subiculum, radiately arranged forming patches 2 to 4 cm. in diameter, entirely covering the subiculum, opening by narrow clefts; asci cylindrical, 8-spored; spores more or less crowded, fusoid, hyaline, 1-septate and constricted at the septum, 20 to 22 by 5 to 6μ.

On rotten wood of various kinds.

A species very distinct from any of the other forms here described in the presence of the black subiculum and the stellately arranged apothecia. The species was wound in great quantity at Mt. Pleasant on decaying logs of butternut. It has also been observed in North Dakota and probably has a wide distribution.

GLONIUM PARVULUM (Ger.) Sacc., Syll. Fung. 2: 735. 1883.

Hysterium parvulum Ger., Bull. Torrey Cl. 5: 40. 1874.

Apothecia densely gregarious, or occasionally scattered, small, .5 to 1 mm. long, roundish, mostly lying parallel with each other, opening with a longitudinal cleft; asci cylindrical, 8-spored; spores very small, hyaline, 1-septate, and constricted at the septum, 7 by 3μ.

On old wood, common.

Quite distinct in the small roundish apothecia and the very small much constricted spores. Ellis makes *G. microsporium* Sacc. identical with this species. Probably common and widely distributed.

GLONIELLA Sacc., Syll. Fung. 2: 765. 1883.

Apothecia erumpent, oblong or linear, carbonaceous, black. with a longitudinal cleft; asci 4 to 8-spored; spores elongated, fusoid, 2 to many-septate, usually 3-septate, hyaline.

One species of the genus collected in the state.

Gloniella ovate (Cooke) Sacc., Syll. Fung. 2: 765. 1883.

Hysterium ovatum Cooke, Grevillea 11: 107. 1883.

Plants gregarious, becoming superficial, ovate, obtuse, black, .5 to 1 mm. in length, longitudinally striated, lips for the most part closed; asci cylindrical to clavate, 8-spored; spores 15 to 18 by 8μ, hyaline, becoming 3-septate.

On oak wood, Mt. Pleasant.

The species was collected in considerable quantity on old wood near Mt. Pleasant. The 3-septate character of the spores was at first overlooked but close examination shows them to be 3-septate at maturity, the middle septum being formed first.

HYSTEROGRAPHIUM Corda, Ic. Fung. 5: 34. 1842.

Plants erumpent, sessile, elongated or elliptical, obtuse or subacute, mostly simple, opening with a narrow, elongated cleft, black, carbonaceous; asci clavate, 8-spored; spores 1 to 2-seriate, elliptical or ovate, obtuse, becoming muriform, brown.

Only three species of this genus collected which seem distinct, but others doubtless occur in the state.

KEY TO THE SPECIES.

Spores large, more than 25μ long.	
Spores 25 to 30 by 8 to 10μ, on bark of oak.	*H. kansense.*
Spores 30 to 40 by 15 to 28μ, on branches of ash.	*H. fraxini.*
Spores small, less than 25μ in length.	*H. mori.*

HYSTEROGRAPHIUM KANSENSE Ellis & Everhart, Erythea 2: 22. 1894.

Plate 41, f. I.

Perithecia scattered, oblong, ends subacute, 1 to 1.25 by .5μ, black, subconchiform, longitudinally striated, lips closed or slightly open so as to leave a narrow cleft; asci clavate, 80 to 110 by 12 to 14μ, 8-spored; spores 2-seriate or partially so, ovate or fusoid, 7 to 9-septate, with most of the cells finally divided by a longitudinal septum, brown, 25 to 30 by 8 to 10μ.

On bark of various species of *Quercus.*

This species has been collected several times by the writer and on the bark of several different species of oak. It was at first taken to be *H. stygium* Cooke, but comparison with an authentic specimen of this species shows the spores to be much too narrow. This difference is also mentioned in the original description of the species. Iowa material conforms well with the type of the species to which it is referred.

HYSTEROGRAPHIUM FRAXINI (Pers.) De Not., Giorn. Bot. It. 2: 22. 1847.

Plate 41, f. III.

Hysterium fraxini Pers., Syn. Fung. 100. 1801.

Plants scattered or gregarious, erumpent, elliptical, black, obtuse, 1 to 1.5 mm. long, .5 to .75 mm. wide; lips swollen, smooth, partially open so as to expose the elongated hymenium; asci clavate, rounded above, 150 to 200 by 30 to 40μ, 8-spored; spores 2-seriate, oblong-elliptical, scarcely constricted in the middle, 7 to 9-septate and muriform, dark brownish, 30 to 40 by 15 to 18μ.

On dead branches of *Fraxinus.*

This species occurs in abundance on the dead branches and twigs of various species of *Fraxinus* before or after the bark is removed. The species appears to be common in localities where the ash is native and its distribution is probably coëxtensive with that of the host.

In North Dakota this species has been observed in great quantities. One collection on branches of *Xanthoxylum americanum* seems identical both in internal and external characters.

HYSTEROGRAPHIUM MORI (Schw.) Rehm,, Ber. Natuhr. Ver. Augsburg 26: 90. 1881.

Plate 41, f. II.

Hysterium mori Schw., Trans. Am. Phil. Soc. II. 4: 244. 1832.

Plants erumpent-superficial, elliptical to linear or cylindrical, 1 to 3 mm. long, and .5 to 1 mm. wide, mostly straight or lying parallel with the grain of the wood, gregarious or crowded, often covering the substratum more or less longitudinally striated; lips mostly closed at first, finally more or less spreading; asci cylindrical, about 100 by 12μ, 8-spored; spores 1-seriate or more or less crowded together above, ovate, smaller below, 3 to 5-septate, a little constricted at the middle septum, cells divided by a longitudinal septum, brown, 15 to 25 by 7 to 8μ.

On decorticated wood of various kinds.

This is a very common, abundant and variable species, occurring on nearly every kind of wood. Specimens found commonly on old wood of butternut conform well with the description of *H. cinerascens* Schw., but I can find no reliable character by which it can be distinguished from the present species.

BIBLIOGRAPHY

Auerswald, B., Sarcosphaera Awd. novum genus Discomycetum. Hedwigia 8: 82-83. 1869.

***Afzelius, A.** De vegetabilius Suecanis observationes et experimenta. Vet. Acad. Handl. 1785.

De Albertini, J. B. & Schweinitz, L. D. Conspectus Fungorum in Lusatiæ superioris agro Niskiensi crescentium, e methodo Persooniana. 1805.

*Literature not accessible to the writer, citations given on other authority than our own.

DeBary, H. A. Comparative Morphology and Biology of the fungi, mycetozoa and bacteria. 1887.

Berkeley, Rev. M. J. Outlines of British Fungology; containing characters of above a thousand species of fungi, and a complete list of all that have been described as natives of the British Isles. London. 1860.

————Notices of Brtish Fungi. Ann. Mag. Nat. Hist. 1838-1848.

————Notices of North American Fungi. Grevillea **3**: 145-160. 1875.

————& Broome, C. E. Notices of British Fungi. Ann. Mag. Nat. Hist. 1848-1883.

Bosc, M. Mémoire sur quelques espèces de Champignons des parties méridionales de l'Amérique Septentrionali. Berl. Mag. 5: 83-89. 1811.

Boudier, M. E. Mémoire sur les Ascobolés. Ann. Sci. Nat. V. **10**: 191-268, pl. 5-12. 1869.

————Nouvelle classification naturelle des discomycètes charnus. Bull. Soc. Myc. 1: 91-120. 1885.

————On the importance that should be attached to the dehiscence of asci in the classification of the Discomycètes. Grevillea **8**: 45-48. 1879. (A translation by W. Phillips).

————Nouvelles espèces de Champignons de France. Bull. Soc. Myc. France. **10**: 59-68, pl. 1, 2. 1894.

Bulliard, P. Herbier de la France, ou collection complette des plantes indigènes de ce royaume, avec leurs détails anatomiques, leurs propriétés et leurs usages en medecine. 12 vols. Paris. 1780-1795.

————Histoire des champignons de la France, ou traité élémentaire renfermant dans un ordre méthodique les descriptiones et les figures des champignons qui croissent naturellement en France. 1791-1812.

***Carus, F. W.** In Nov. Act. Ac. Nat. Cur. 17: 370-375, pl. 10-31. 1864.

Caspary, R. Sarcosoma in Rabenh. Krypt. Fl. 1^3: 497. 1896.

Cooke, M. C. Pezizæ Americanæ a M. C. Cooke descriptae. Hedwigia 14: 81-85. 1875.

————Mycographia, seu Icones Fungorum; figures of fungi from all parts of the world drawn and illustrated by M. C. Cooke, M. A., A. L. S., etc., vol. 1 Discomycetes. 1875-1879.

————North American Fungi. Grevillea 11: 106-111. 1883.

Corda, A. C. I. Icones fungorum hucusque cognitorum. 6 vols. 1837-1854.

Crouan, M. M. Note sur quelques Ascobolus nouveaux et sur une espèce nouvelle de Vibrissea. Ann. Sci. Nat. IV. **7**: 173-178, pl. 4. 1857.

Crouan, M. M. Note sur neuf Ascobolus nouveaux. Ann Sci. Nat. IV. 10: 193-199. 1858.

Currey, Frederick. Notes on British Fungi. Trans. Linn. Soc. 24: 151-160, pl. 25 and 24: 491-496, pl. 51. 1864.

Desmazières, J. B. H. J. Notice sur quelques cryptogames nouvelles qui ont ete publiées, en nature, dans les fascicules 14-17 des plantes cryptogames de France (1). Ann. Sci. Nat. II. 6: 242-247. 1836.

Dillenius, J. J. Appendix ad catalogum sponte circa Giessam nascentium. 1719.

Duby, J. E. De Candolle, Botanicon Gallicum seu synopsis plantarum in flora Gallica descriptarum. 1830.

Durand, E. J. The classification of the fleshy Pezizineæ with reference to the structural characters illustrating the basis of their division into families. Bull. Torrey Cl. 27: 463-495. 1900.

——————Studies in North American Discomycetes I. The genus Holwaya Sacc. Bull. Torrey Cl. 28:348-355, pl. 26. 1901.

——————Studies in North American Discomycetes II. Some new or noteworthy species from central and western New York. Bull. Torrey Cl. 29: 458-465. 1902.

——————Peziza fusicarpa Ger. and Peziza semitosta B. & C. Jour Myc. 12: 28-32. 1906.

Ellis, J. B. New species of North American Fungi. Am. Nat. 17: 192-196. 1883.

——————New North American Fungi. Bull. Torrey Cl. 9: 18-20. 1882.

——————& **Everhart, B. M.** New West American Fungi. Erythea 2: 17-26. 1894.

——————New Species of Fungi. Bull. Torrey Cl. 10: 97-98. 1883.

——————& **Holway, E. W. D.** New Fungi from Iowa. Jour. Myc. 1: 4-6. 1885.

Fries, Elias. Systema Orbis Vegetabilis. Primas lineas novæ constructionis periclitatur. 1825.

——————, Elenchus Fungorum, sistens commentarium in systema mycologicum. 2 vols. 1828.

——————, Systema mycologicum sistens fungorum ordines, genera et species huc usque cognitas, quas normam methodi naturalis determinavit, disposuit atque descripsit. 3 vols. 1821, 1822, and 1829.

——————Summa vegetabilium Scandinaviæ, seu enumeratio, systematica et critica, plantarum tum cotyledonarum quum nemearum inter mare occidentale et album, inter Eidoram et Nordkap, hactenus lectarum, una cum singulæ distributione geographica. 1845-1849.

Fuckel, L. Ueber rheinische Ascobolus-arten. Hedwigia 5: 1-5. pl. 1. 1866.

————Symbolæ mycologicæ; beiträge zur kenntiss der rheinischen pilze. Jahr. Nass. Vereins Nat. 23, 24, 25, and 26. 1869-1871.

Gerard, W. R. New species of Fungi. Bull. Torrey Cl. 4: 64. 1873.

————New Fungi. Bull. Torrey Cl. 5: 39-40. 1874.

Gillet, C. C. Champignons de France. Les Discomycétes. 1879-1888.

Greville, R. K. Flora Edinensis; or A description of plants growing near Edinburg, arranged according to the Linnean system with a concise introduction to the natural orders of the class **Cryptogamia,** and illustrative plates. 1824.

Hedwig, D. R. A. Microscopisch-analytische Beschreibungen und Abbildungen neuer und zweifelhafter Laub-moose wie auch anderer zu der cryptogamischen Classe des Linné gehöriger Gewächse. vol. 2. 1789.

————Observationum Botanicarum, fasc. 1. 1802.

Hoffman, G. F. Vegetabilia cryptogamica, fasc. 2. 1790.

Jacquin, N. J. Miscellanea austriaca ad botanicam, chemiam, et historiam naturalem spectantia cum figuris. vol. 2. 1781.

Karsten, P. A. Monograph Pezizarum fennicarum. Not. Sall| Fauna Fl. Fenn. Forch. 10: 101-206. 1869.

————Revisio monographica atque synopsis Ascomycetum in Fennia hucusque detectorum. Act. Soc. Fauna Fl. Fenn 2: 1-174. 1885.

————Symbolæ ad mycologiam Fennicam. Medd. Soc. Fauna Fl. Fenn various volumes.

Koerber, G. W. Parerga lichenologica ergänzungen zum systema lichenum Germaniæ. 1865.

Kunze, G. und Schmidt, J. C. Mykologische Heft, nebst einem allgemeinbotanischen Anzeiger. 1817.

Leveille, M. J. H. Fragments Mycologiques. Ann. Sci. Nat. III. 9: 119-144. 1848.

Linnaeus, C. Flora Suecica exhibens plantas per regnum Sueciæ crescentes, systematice cum differentiis specierum, synonymis autorum, nominibus incolarum solo locorum usu pharmacopæorum. 1755.

————Species Plantarum, exhibentes plantas rite cognitas, ad genera relatas, cum differentiis specificis, nominibus trivialibus, synonymis selectis, locis natalibus, secundum systema sexuale digestas. 2 vols. 1753.

Massee, G. Redescription of Berkeley's types of fungi. Part II. Jour. Linn. Soc. 35: 90-118, pl. 4, 5. 1901.

————Peziza rutilans Fr., and Peziza polytrichi, Schum. Grevillea 22: 107-111, pl. 1894.

Massee, G. & Crossland, C. The fungous-flora of Yorkshire: a complete account of the known fungi of the county. Traus. York. Nat. Union 4. 1905.

Morgan, A. P. The Discomycetes of the Miami valley, Ohio. Jour. Myc. 8: 179-192. 1902.

Mueller, O. F. Icones plantarum sponte nasoentium in regnis Danicæ et Norvegiæ et in ducatibus Slesvici, Holsatiæ et Oldenburg: ad illustrandum opus de iisdem plantis, regio jussu exarandum, Floræ Danicæ. 5. 1782.

Nees, C. G. Das System der Pilze und Schwämme. 1817.

***de Notaris G.** Osservazioni sul genere Patellaria, Parlatore. Giorn. Bot. It. 1: 224-232. 1846.

————Proposte di alcune rettificazioni al profilo dei discomiceti. Comm. Soc. Critt. It. 1: 357-388. 1864.

†Nylander, W. Observationes circa Pezizas fenniæ. Not. Saell. Fauna Fl. Fenn. 1868.

Oeder, G. C. Icones plantarum sponte nascentium in regnis Daniæ et Norvegiæ, ducatibus Slesvici et Holsatiæ, et in comiatibus Oldenburg et Delmenhorstiae Florae Danicae inscriptum 3, pl. 464, 534, regio jussu exarandum Florae Danicae inscriptum 3, pl. 464, 534, and 169. 1770.

Persoon, C. H. Observationes mycologicae seu descriptiones tam novorum, quam notabilium fungorum exhibitae. 1. 1796.

————Tentamen dispositionis methodicae fungorum in classes, ordines, genera et familias cum supplemento adjecto. 1797.

————Icones et descriptiones fungorum minus cognitorum. Fasc. 1. 1798, Fasc. 2. 1800.

————Synopsis methodica fungorum, sistens, Enumerationem omnium huc usque detectarum specierum, cum brevibus descriptionibus nec non synonymis et observationibus selectis. 1801.

————Icones pictae rariorum fungorum. 1803-1806.

————Mycologia Europaea seu complete omnium fungorum in variis Europaeae regionibus detectorum enumeratio, methodo naturali disposita: descriptione succincta, synonymia selecta et observationibus criticis additis. 3 vols. 1822, 1825, and 1828.

Peck, C. H. Annual Report on the New York State Museum of Natural History 24: 83 and 97. 1871, 28: 69. 1879 and 35: 143. 1882.

Phillips, W. Fungi of California (Collected by Dr. H. W. Harkness and Mr. J. P. Moor). Grevillea 7: 20-23. 1878.

†A synopsis of this paper is contained in Bull. Soc. Bot. France. 16: 23 The original has not been seen.

Phillips, W. A manual of the British discomycetes with descriptions of all the species of fungi hitherto found in Britain, included in the family and illustrations of the genera. 1887.

————— **& Plowright, C. B.** New and rare British fungi. Grevillea 2: 186-189. 1874.

Quelet, L. Some new species of fungi from Jura and the Vosges. Grevillea 8: 115-117. 1880.

—————Quelques espèces critiques ou nouvelles de la flora mycologique de France. Assoc. Franc. l'Advanc. Sci. 142: 444-454. 1886.

—————Enchiridion fungorum in Europa media et præsertim in Gallia vigentium. 1886.

Rabenhorst, L. Peziza Dehnii eine neue Pilzform. Bot. Zeitung 1: 11-12. 1843.

—————Krypt. Fl. (see Rehm)

Reade, J. M. Preliminary notes on some species of Sclerotinia. Ann. Myc. 6: 109-115. 1908.

Rehm, H. Ascomyceten. Fasc 1-11. Ber. Naturh. Ver. Augsburg 26: 1-132. 1881.

—————Die Pilze Deutschlands, Oesterreichs und der Schweiz. Ascomyceten: Hysteriaceen und Discomyceten. Rabenh. Krypt. Fl. 1^3: 1896.

—————Ascomycetes Americae borealis. Ann. Myc. 3: 516-520. 1905.

—————Ascomycetes exs. Fasc. 36. Ann. Myc. 4: 64-71. 1906.

—————Ascomycetes novi. 1. Ascomycetes Americae borealis. Ann. Myc. 4: 336-338. 1906.

—————Ascomycetes exs. Fasc. 38. Ann. Myc. 5: 78-85. 1907.

Rouppert, C. Revision du genre Sphaerosoma. Bull. Acad. Sci. Cracavie for 1909: 75-95. 1909.

Saccardo, P. A. Fungi Veneti novi vel critici vel mycologiae venetae addendi. Michelia 1: 1-72. 1879.

—————Conspectus generum Discomycetum hucusque cognitorum. Bot. Cent. 18: 213-220. 1884.

—————Sylloge Fungorum. 8. 1889.

Schaeffer, J. C. Fungorum qui in Bavaria et Palatinatu circa Ratisbonam nascuntur icones nativis coloribus expressae. 3 vols. 1762, 1767, and 1770.

Schrader, H. A. Plantae cryptogamicae novae, rariores aut minus cognitae. Jour. fur die Bot. 2: 55-70. 1799.

Schroeter, J.; E. & P. Nat. Pfl. 1^1. 1897.

Schumacher, C. F. Enumeratio plantarum in partibus Saellandiae septentrionalis et orientalis. 2 vols. 1801 and 1803.

de Schweinitz, L. D. Synopsis fungorum Carolinae superioris secundum observationes. Schr. Nat. Ges. Leipzig **1**: 26-131, pl. 1, 2. 1818.

——————Synopsis fungorum in America boreali media degentium secundum observationes. Trans. Am. Phil. Soc. **4**: 141-316. 1832.

Scopoli, J. A. Flora Carnolica exhibens plantas Carnioliae indigenas et distributas in classes, genera, species, varietates, ordine Linnaeano. vol 2: 1772.

Seaver, F. J. Discomycetes of eastern Iowa. Bull. Lab. Nat. Hist. St. Univ. Iowa. **5**: 335-407, pl. 1-25. 1904.

——————A new species of Sphaerosoma. Jour. Myc. **11**: 2-5, pl. 1905.

——————An annotated list of Iowa discomycetes. Proc. Iowa Acad. Sci. **12**: 105-120. 1905.

——————Notes on the discomycete flora of Iowa. Proc. Iowa Acad. of Sci. **13**: 71-74. 1906.

——————Discomycetes of North Dakota. Mycologia **1**: 104-114. 1909.

——————Studies pyrophylous fungi—I. Occurrence and cultivation of Pyronema. Mycologia **1**: 131-139. 1909.

Sowerby, J. Coloured figures of English fungi or mushrooms. 3 vols. 1797, 1799, and 1803.

Tulasne, L. R. Selecta fungorum carpologia, et documenta et icones potissimum exhibens quae varia fructuum et seminum genera in

Weinmann, J. A. Hymeno-et gastero-mycetes hucusque in imperio rostriei, Phacidiei, Pezizei. 1865.

Tode, H. I. Fungi Mecklenburgenses selecti. Fasc. 1 and 2. 1790 and 1791.

Vahl, M. Florae Danicae (l. c.) pl. 1200. 1797.

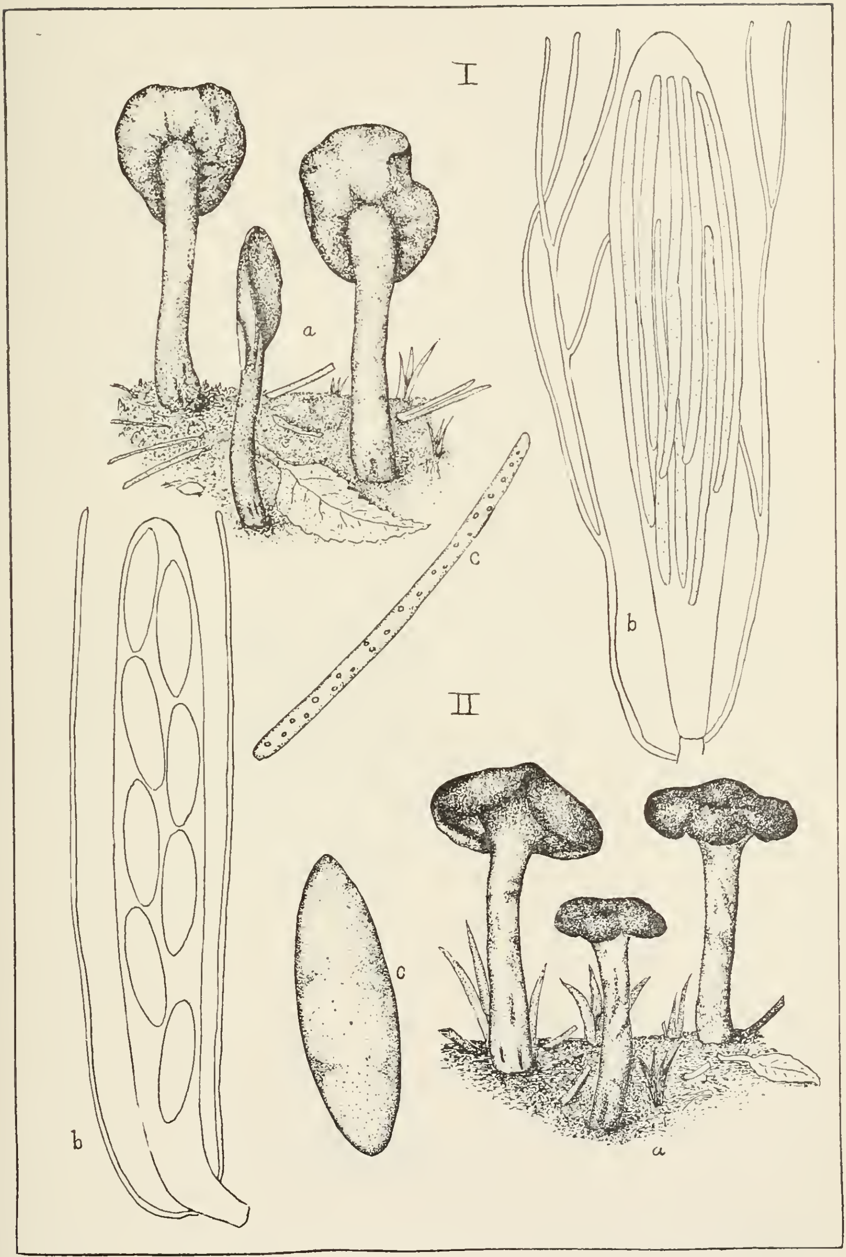
Weinmann, J. A. Hymeno-et gastero mycetes hucusque in imperio rossico observatos. 1836.

EXPLANATION OF PLATE 1

I. SPATHULARIA CLAVATA (Schæff.) Sacc.
  a. Plants showing habitat, natural size.
  b. Ascus and paraphyses × 1000.
  c. One spore × 1200.

II. LEOTIA STIPITATA (Bosc.) Schrœt.
  a. Plants natural size.
  b. Ascus with paraphyses × 750.
  c. One spore × 2000.

PLATE 1



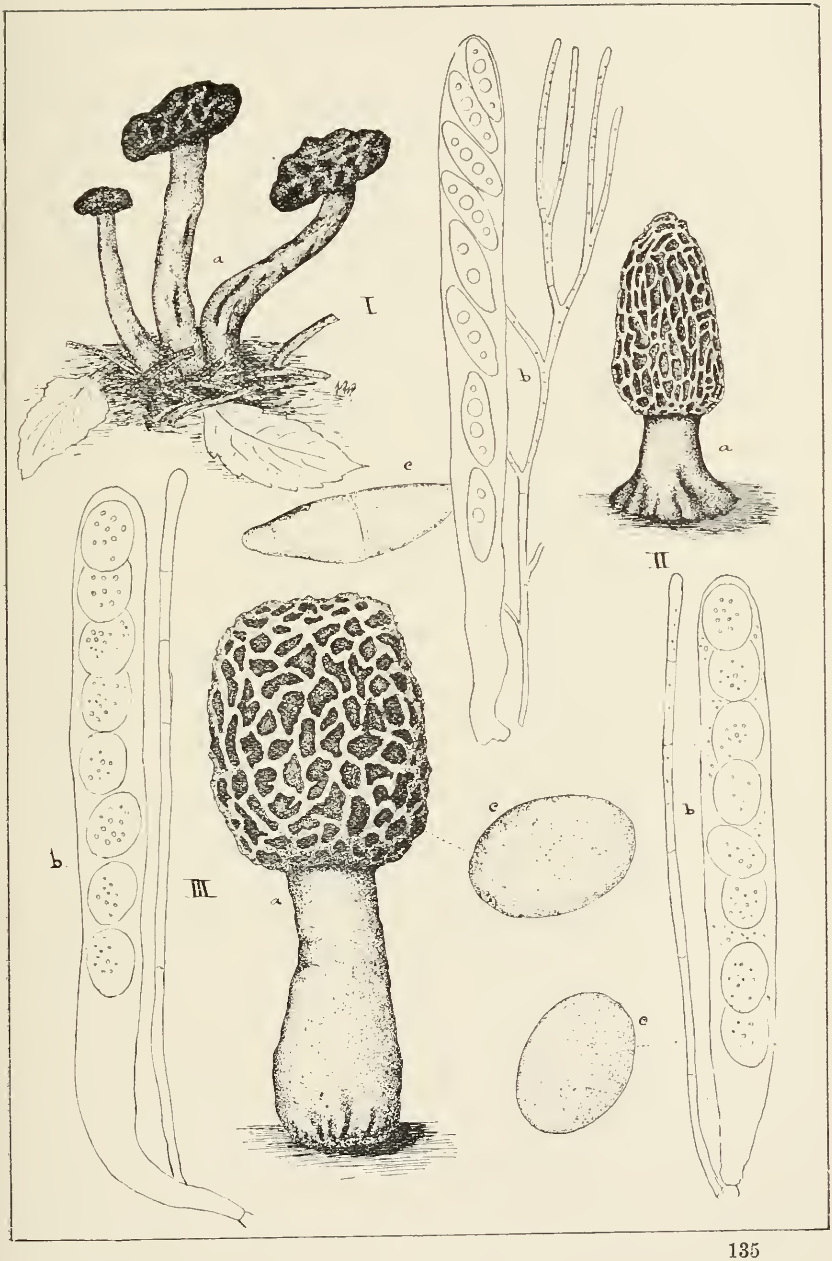
EXPLANATION OF PLATE 2

I. LEOTIA LUBRICA (Scop.) Pers.
   - a. Cluster of plants natural size.
   - b. Ascus with paraphysis and spores × 500.
   - c. One spore × 1500.

II. MORCHELLA DELICIOSA Fries.
   - a. One plant natural size.
   - b. Ascus with paraphysis and spores × 500.
   - c. One spore × 1200.

III. MORCHELLA ESCULENTA (L.) Pers.
   - a. One plant natural size.
   - b. Ascus with paraphysis and spores × 500.
   - c. One spore × 1200.

Plate 2


a
I
b
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a
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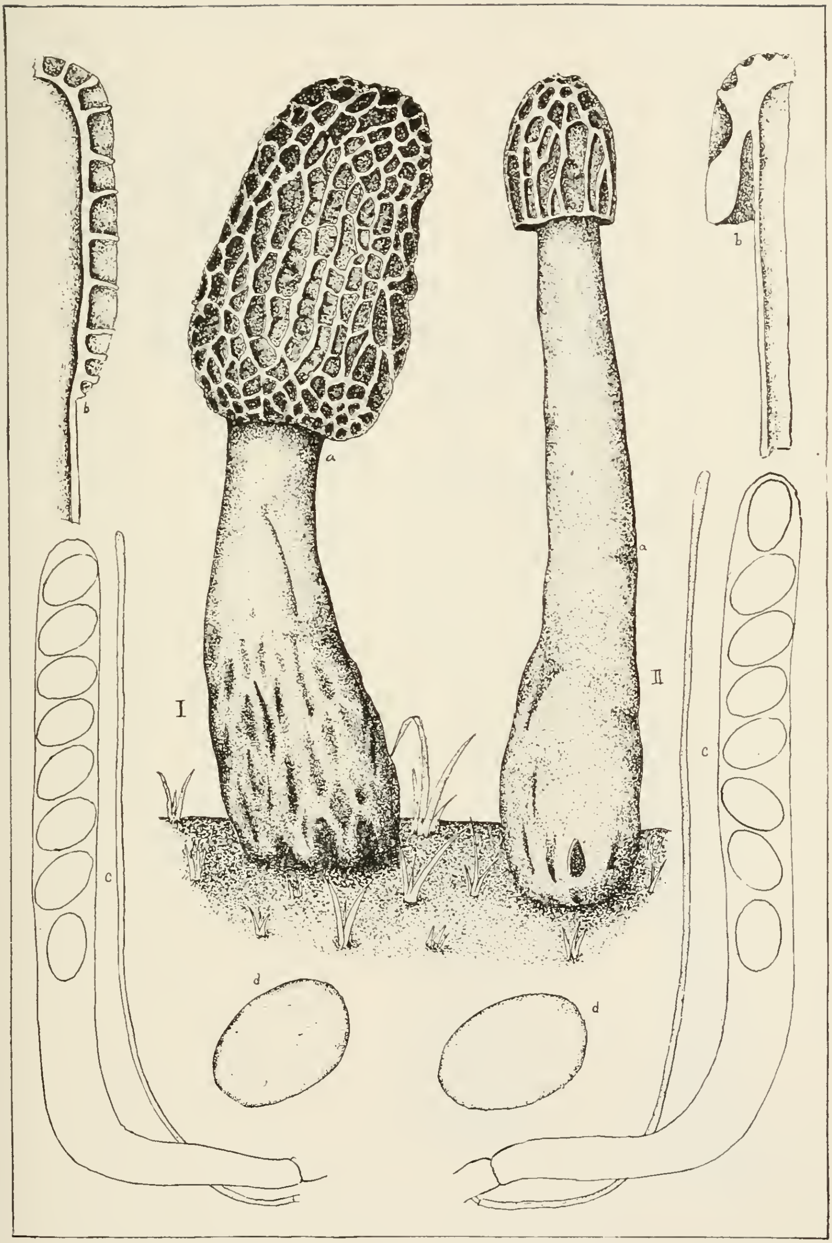
c

EXPLANATION OF PLATE 3

I. MORCHELLA CONICA Pers.
   a. Plants natural size.
   b. Section to show pits.
   c. Ascus with paraphyses × 500.
   d. One spore × 750.

II. MORCHELLA HYBRIDA (Sow.) Pers.
   a. One plant natural size.
   b. Section to show free pileus and pits.
   c. Ascus with paraphyses × 400.
   d. One spore × 800.

Plate 3


b
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I
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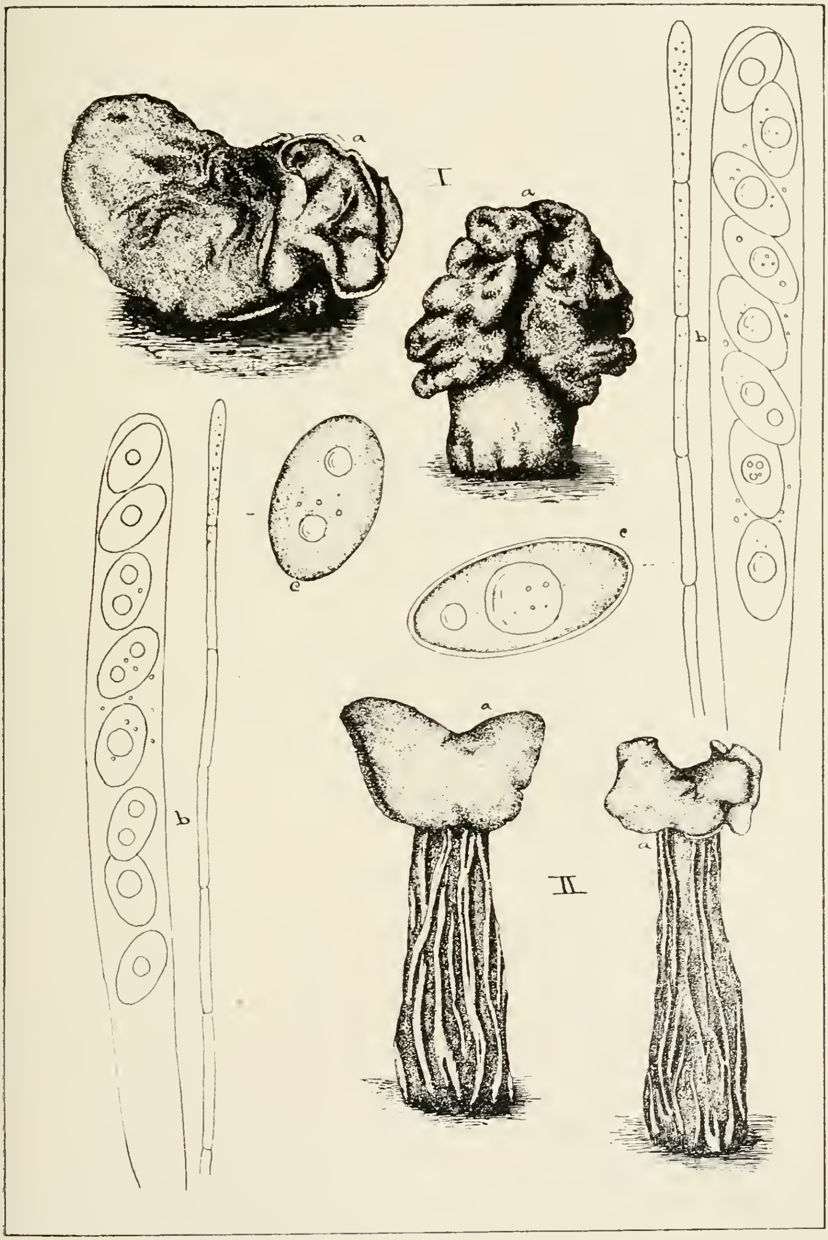
b
a
II
c
d

EXPLANATION OF PLATE 4

I. GYROMITRA ESCULENTA (Pers.) Fries.
  a. Plants natural size.
  b. Ascus with paraphysis and spores × 700.
  c. One spore × 1500.

II. HELVELLA LACUNOSA Afzel.
  a. Plants natural size.
  b. Ascus with paraphysis and spores × 700.
  c. One spore × 1500.

PLATE 4


a
I
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b
c
c
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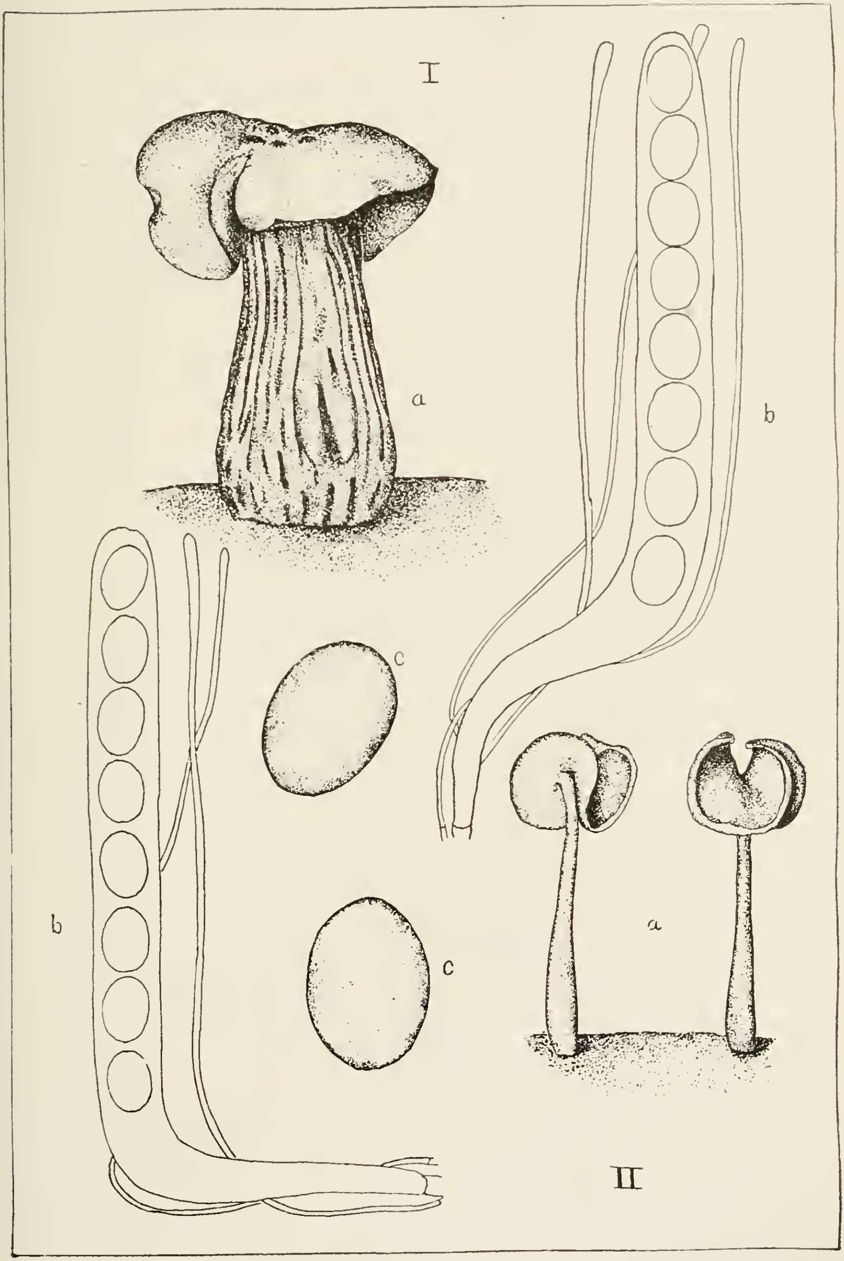
a
II

EXPLANATION OF PLATE 5

I. HELVELLA CRISPA (Scop.) Fries.
  a. One plant natural size.
  b. Ascus with paraphyses × 600.
  c. One spore × 1400.

II. HELVELLA ELASTICA Bull.
  a. Two plants natural size.
  b. Ascus with paraphyses × 500.
  c. One spore × 1200.

Plate 5

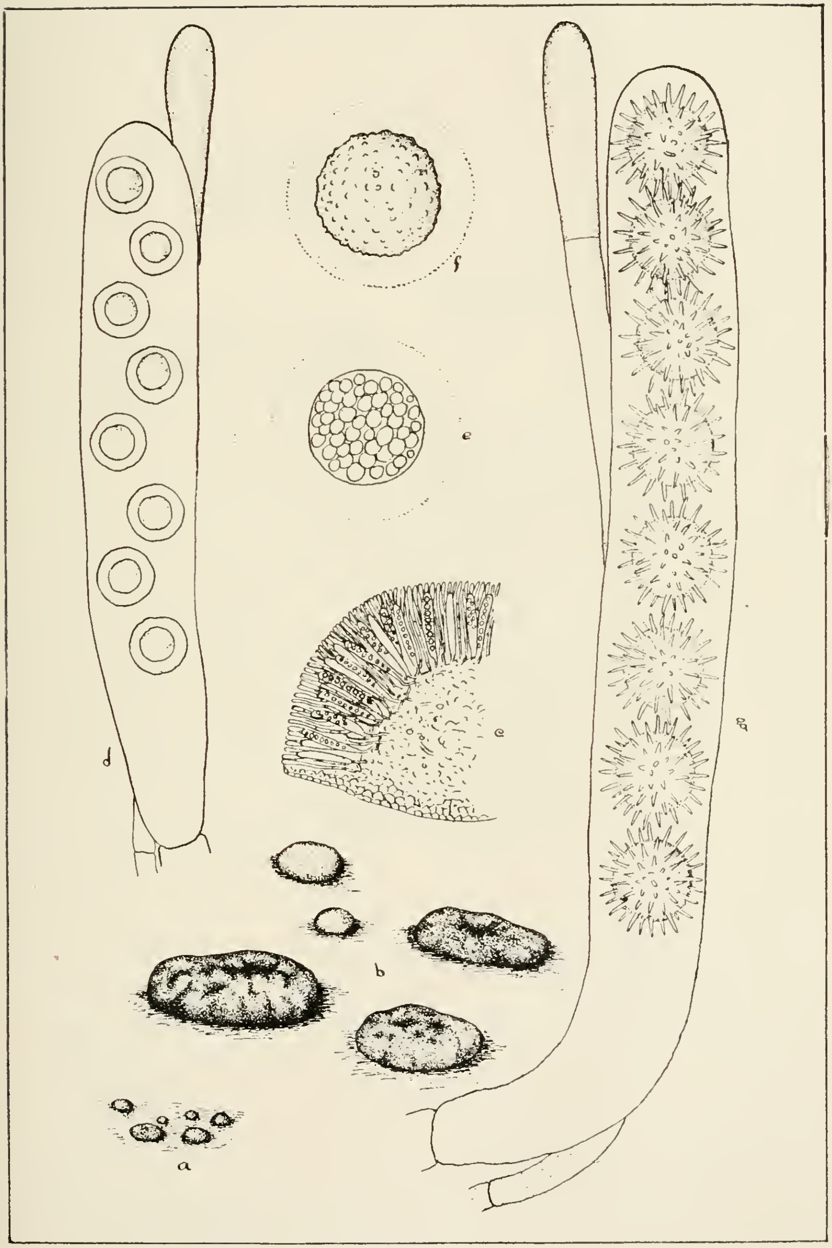


Explanation of Plate 6

Sphærosoma echinulatum Seaver.

a. Several plants natural size.
b. Plants of different ages × 5.
c. Section of a plant showing position of Hymenium × 30.
d. Ascus with spores before maturity × 500.
e. Young spore showing surrounding membrane × 1000.
f. Spore showing the early stages in the roughening of the outer surface × 1000.
g. Ascus with paraphysis and spores at maturity × 600.

PLATE 6

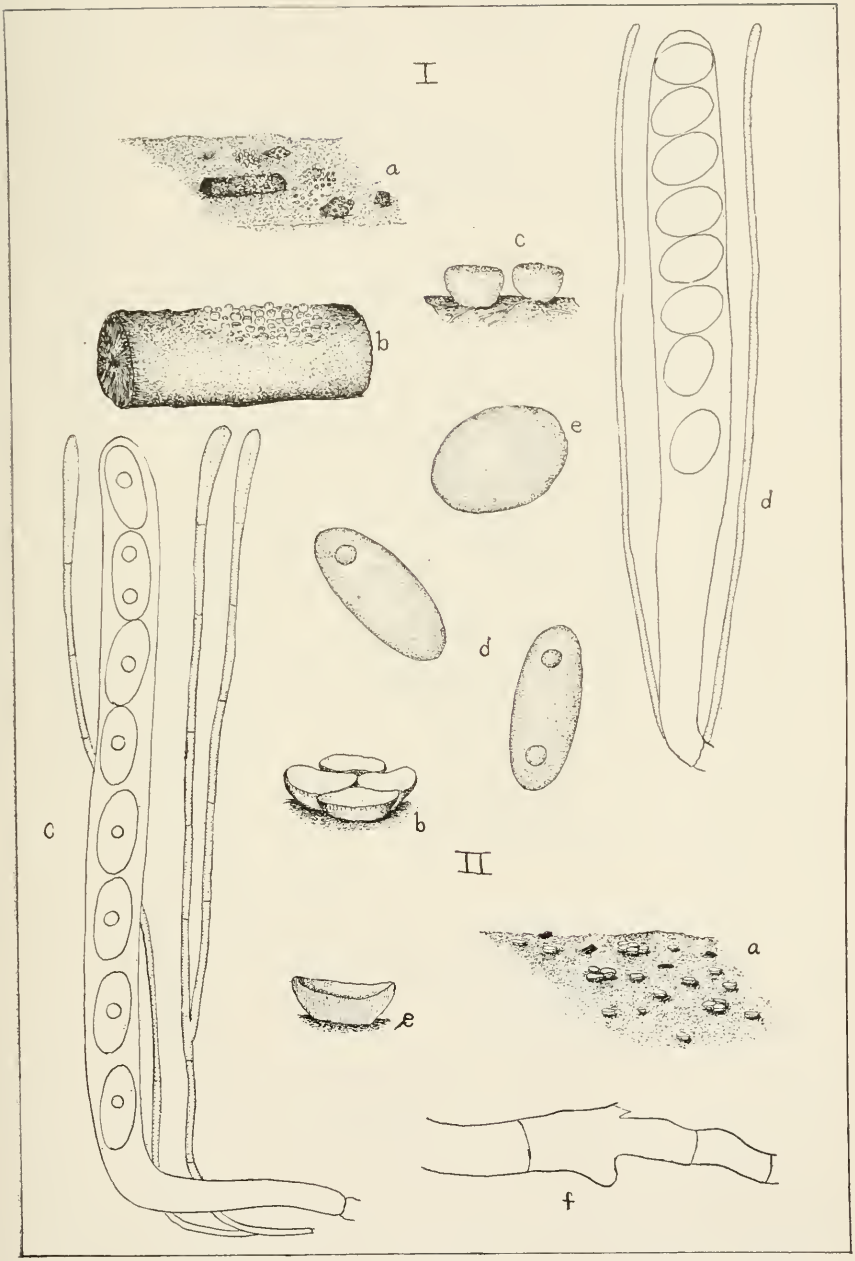


EXPLANATION OF PLATE 7

I. PYRONEMA OMPHALODES (Bull.) Fuckel.
- a. Group of plants natural size.
- b. Same enlarged several diameters.
- c. Two plants × 10.
- d. Ascus with paraphyses × 1200.
- e. One spore × 2500.

II. PYRONEMA MELALOMA (Fries) Fuckel.
- a. Group of plants natural size.
- b. Several cups × 5.
- c. Ascus and paraphyses × 700.
- d. Spores × 1000.
- e. Section of plant × 5.
- f. Hair-like growth from cup.

Plate 7



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d
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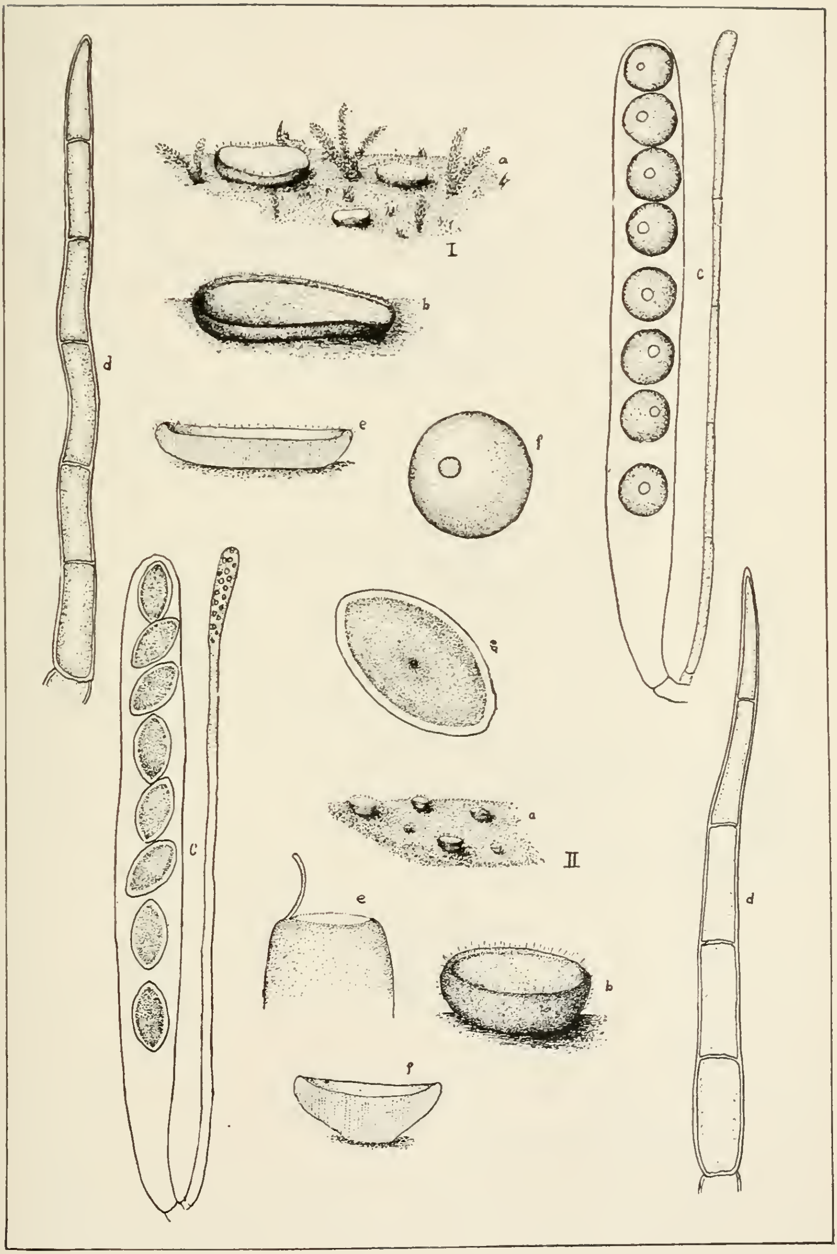
c
b
II
a
e
f

EXPLANATION OF PLATE 8

I. SPHÆROSPORA SCUTELLOIDES Ellis.
  - a. Plants natural size.
  - b. One plant × 3.
  - c. Ascus with paraphyses × 500.
  - d. Hair from margin of cup × 500.
  - e. Diagram section × 3.
  - f. One spore × 1200.

II. LACHNEA LOJKÆNA Rehm.
  - a. Several plants natural size.
  - b. One plant × 10.
  - c. Ascus and paraphyses × 600.
  - d. Hair from cup × 600.
  - e. Ascus to show operculum × 1200.
  - f. Diagram section × 10.
  - g. One spore × 1500.

PLATE 8



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f
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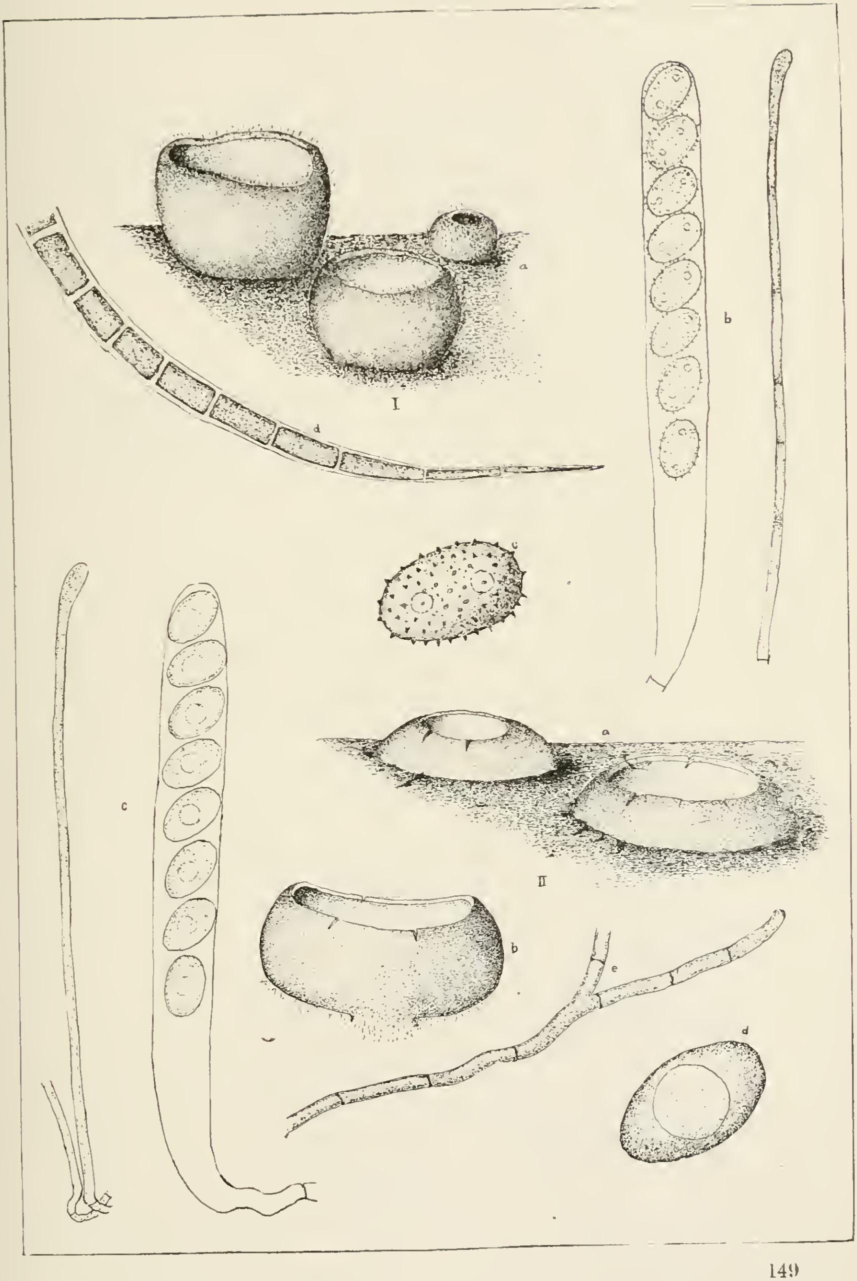
a
II
e
d
b
f

EXPLANATION OF PLATE 9

I. LACHNEA HEMISPHÆRICA (Schaeff.) Gill.
  - a. Several cups natural size.
  - b. Ascus and paraphysis × 400.
  - c. One spore × 1000.
  - d. Hair from cup × 500.

II. SARCOSPHÆRA ARENICOLA (Lev.) Lindau.
  - a. Two cups a little enlarged.
  - b. One cup removed showing hairs.
  - c. Ascus and paraphysis × 400.
  - d. One spore × 1000.
  - e. Portion of hair from cup.

Plate 9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c
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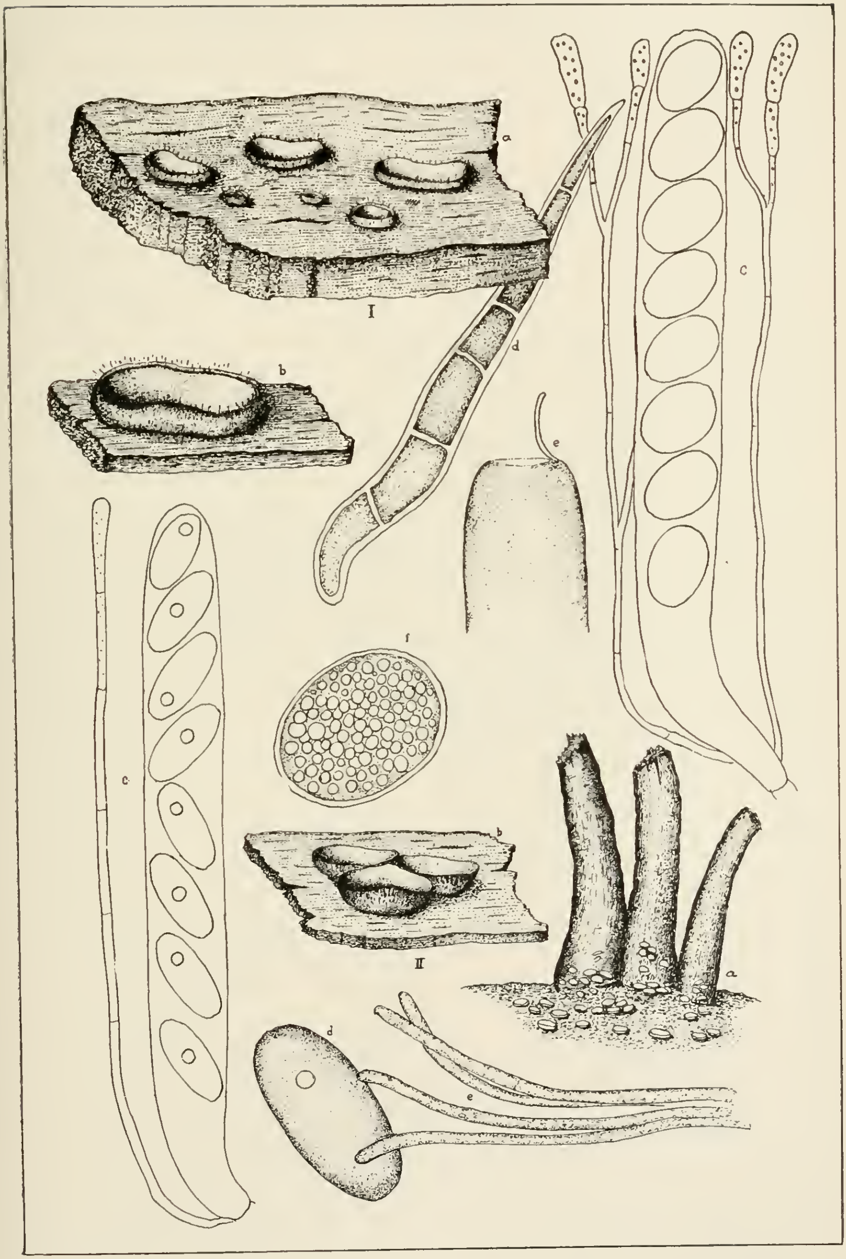
II
b
e
d

Explanation of Plate 10

I. Lachnea scutellata (L.) Gill.
   - a. Plants showing habitat natural size.
   - b. One plant × 2.
   - c. Ascus with paraphyses × 600.
   - d. Hair from cup × 500.
   - e. Ascus to show operculum × 1000.
   - f. One spore × 1200.

II. Lachnea melaloma (Albert. & Schw.) Sacc.
   - a. Plants to show habitat natural size.
   - b. Plants × 5.
   - c. Ascus and paraphysis × 700.
   - d. One spore × 1400.
   - e. Hairs from cup × 700.

PLATE 10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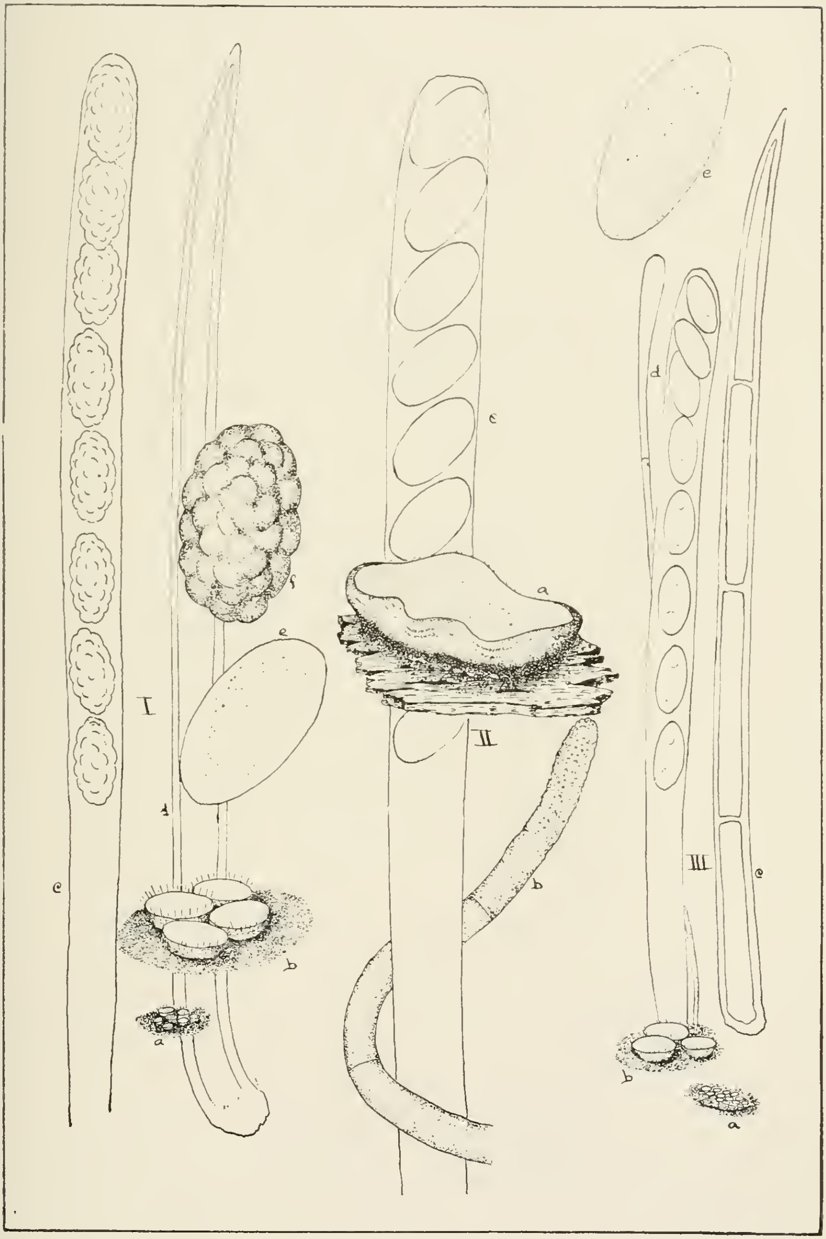
Explanation of Plate 11

I. Lachnea paludosa (Boud.) Sacc.
  a. Plants natural size.
  b. Several plants × 5.
  c. Ascus with spores × 600.
  d. One hair from exterior of cup × 300.
  e. Spore showing internal characters × 1500
  f. Mature spore showing external markings × 1500.

II. Lachnea aurantiopsis Ellis from type material.
  a. One plant about natural size.
  b. Hair from exterior of cup × 500.
  c. Ascus with spores × 500.

III. Lachnea abundans (Karst.) Sacc.
  a. Plants natural size.
  b. Several plants × 5.
  c. Hair from exterior of cup × 600.
  d. Ascus with spores and paraphyses × 800.
  e. One spore × 2500.

PLATE 11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a

EXPLANATION OF PLATE 12

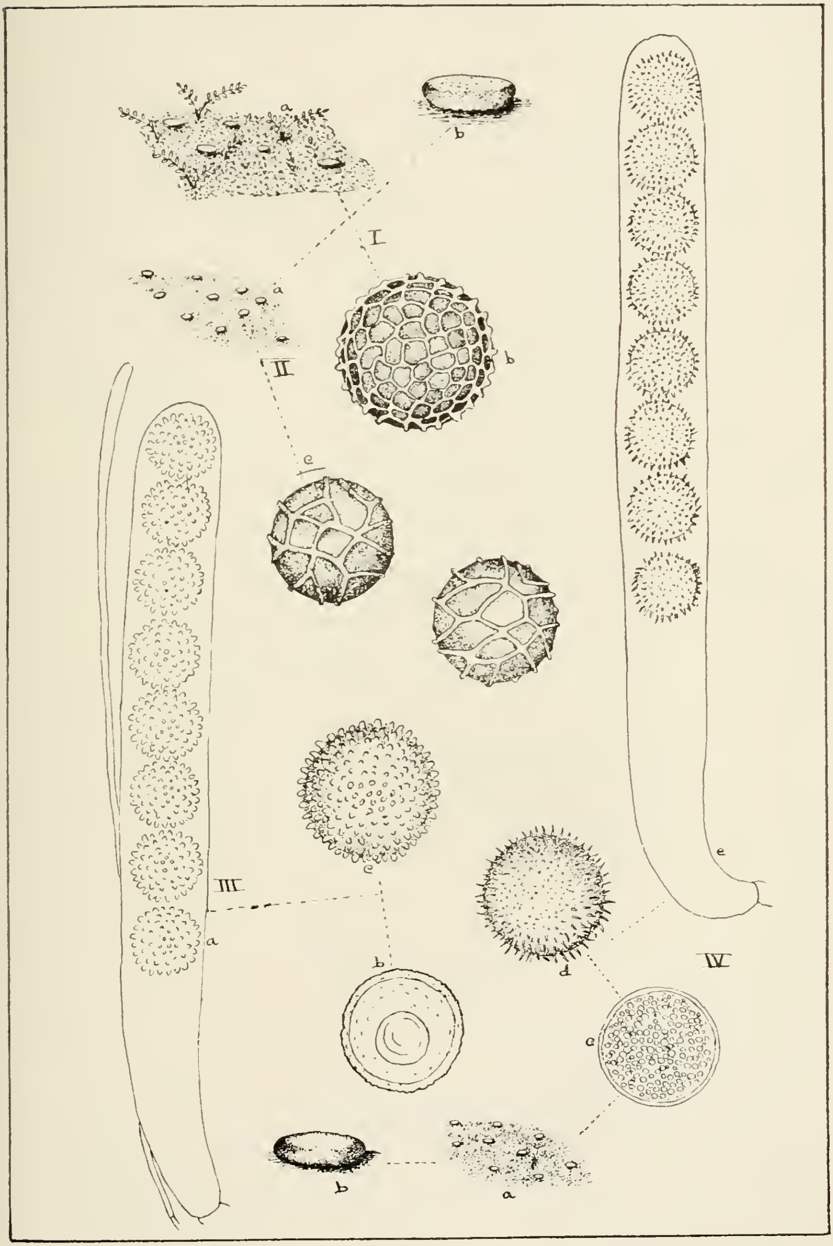
I. BARLÆA MINIATA (Crouan) Sacc.
  a. Plants natural size.
  b. One spore × 1500.

II. BARLÆA CINNABARINA (Fuckel) Sacc.
  a. Plants natural size.
  b. Two spores × 1200.

III. BARLÆA AMETHYSTINA (Quel.) Sacc.
  a. Ascus with spores and paraphyses × 600.
  b. One spore showing internal markings × 1500.
  c. One spore showing external markings × 1500.

IV. BARLÆA CREC'HQUERAULTII (Crouan) Sacc.
  a. Plants natural size.
  b. One plant × 5.
  c. Immature spore × 1500.
  d. Mature spore showing external characters × 1500.
  e. Ascus with spores × 600.

PLATE 12


a
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I
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II
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III
e
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e
IV
d
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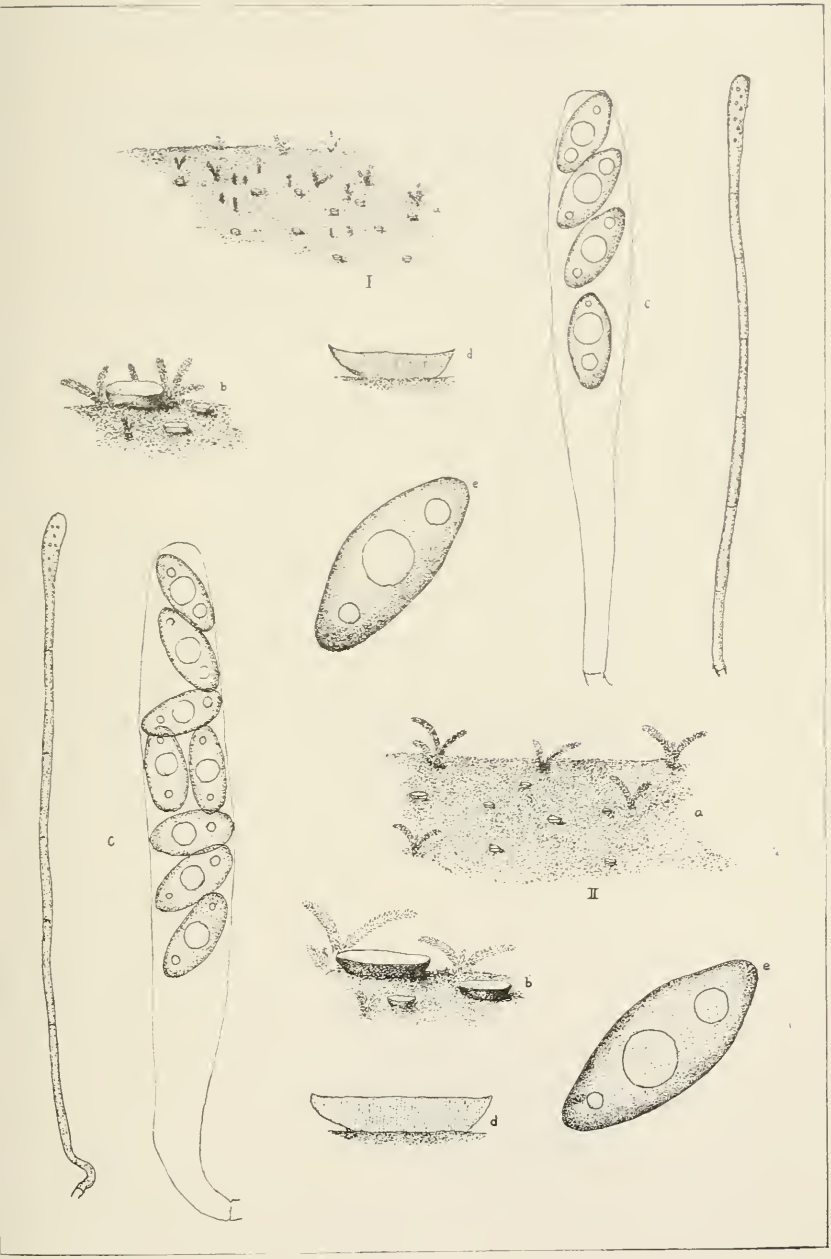
a

EXPLANATION OF PLATE 13

I. HUMARIA TETRASPORA (Fuckel) Sacc.
  a. Several plants natural size.
  b. Three plants × 5.
  c. Ascus and paraphysis × 600.
  d. Diagram section × 10.
  e. One spore × 1500.

II. HUMARIA MURALIS (Quel) Sacc.
  a. Plants showing habitat natural size.
  b. Plants × 5.
  c. Ascus and paraphysis × 400.
  d. Diagram section × 10.
  e. One spore × 1000.

PLATE 13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C
a
II
b
e
d

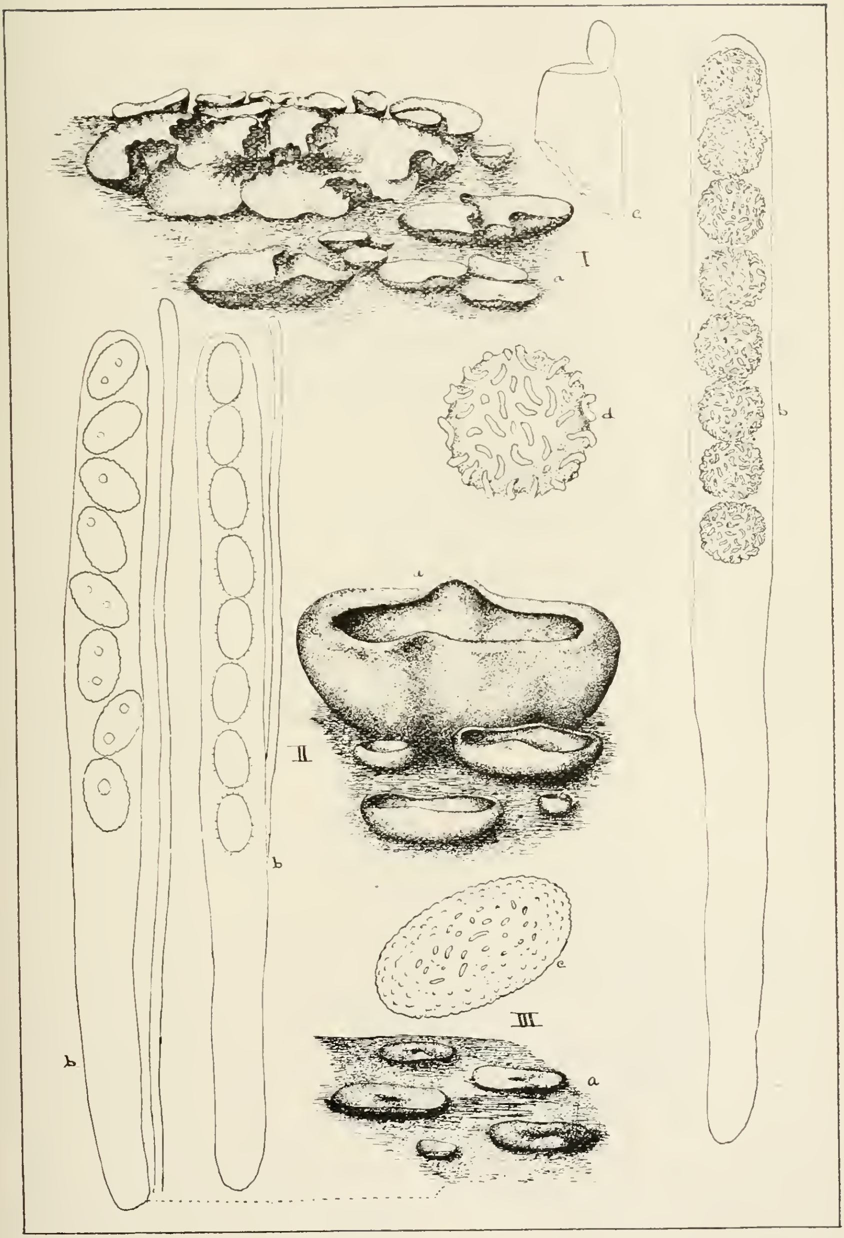
EXPLANATION OF PLATE 14

I. DETONIA TRACHYCARPA (Curr.) Sacc.
  a. Plants natural size.
  b. Ascus with spores × 700.
  c. Ascus showing operculum × 1000.
  d. One spore showing external markings × 1500.

II. PEZIZA BADIA Pers.
  a. Plants natural size.
  b. Ascus with spores and paraphysis × 600.

III. PEZIZA BRUNNEO-ATRA Desm.
  a. Plants natural size.
  b. Ascus with spores × 500.
  c. One spore showing markings × 1500.

PLATE 14

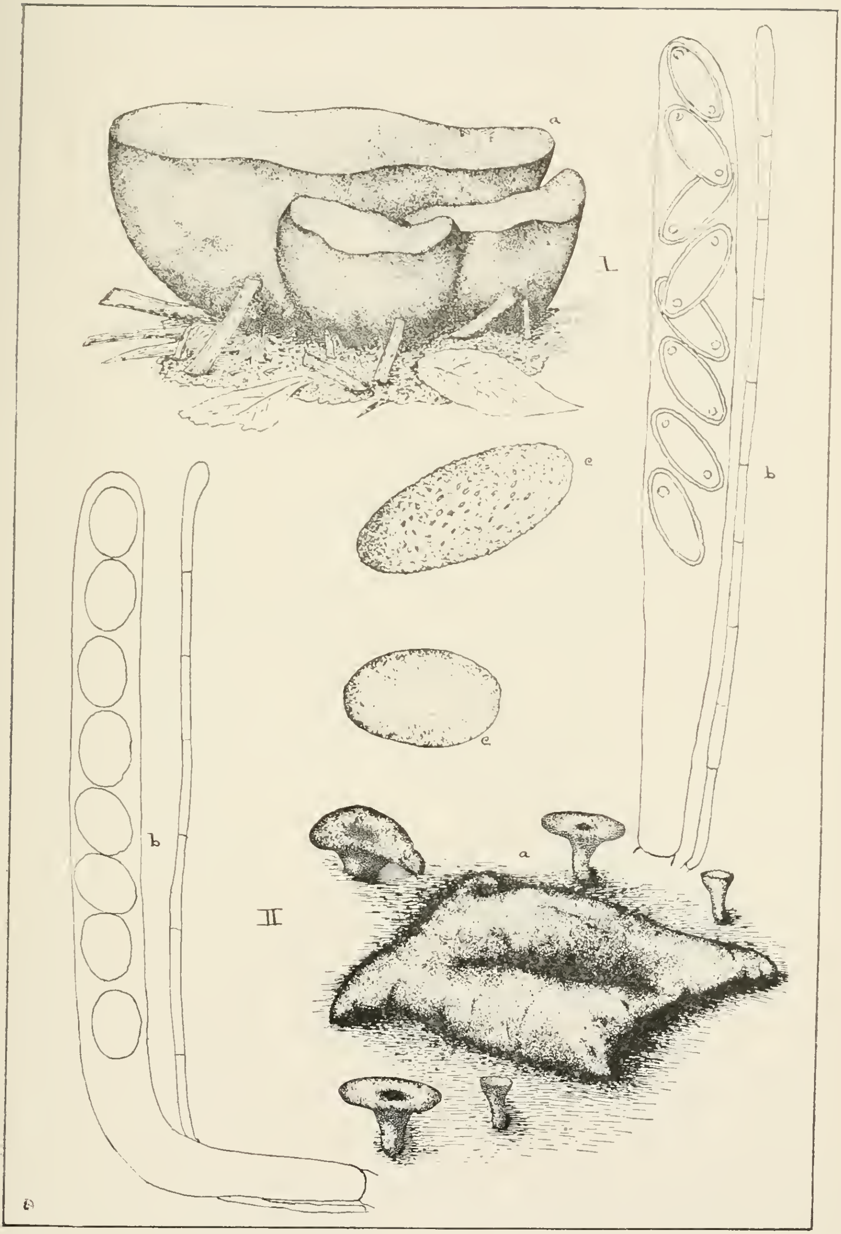

c
I
a
b
d
b
a
II
b
e
III
a

EXPLANATION OF PLATE 15

I. PEZIZA BADIA Pers. (form collected in deep woods).
  a. Plants natural size.
  b. Ascus with spores and paraphysis × 800.
  c. One spore showing markings × 1500.

II. PEZIZA REPANDA Pers.
  a. Plants of several ages natural size.
  b. Ascus with spores and paraphysis × 700.
  c. One spore × 1500.

PLATE 15

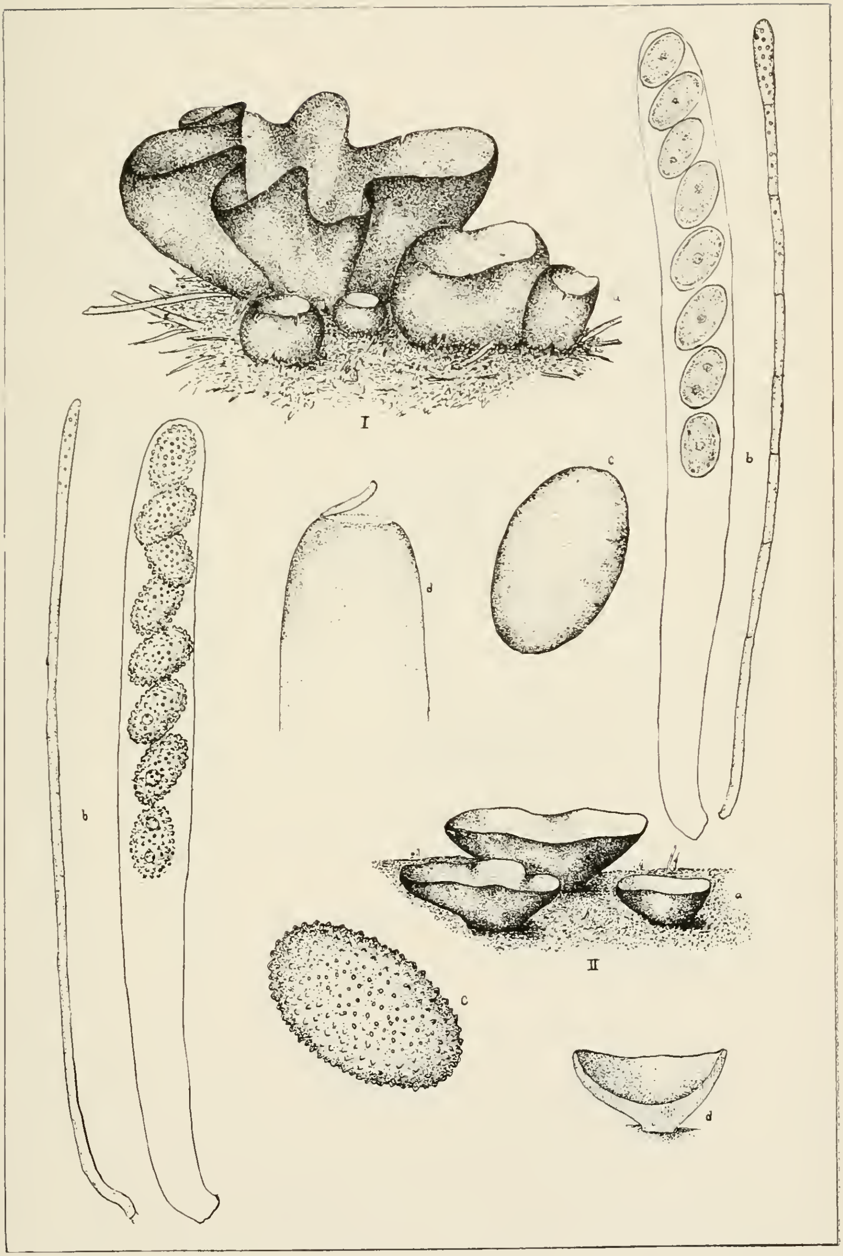


EXPLANATION OF PLATE 16

I. PEZIZA VESICULOSA Bull.
  a. Several cups a little reduced.
  b. Ascus and paraphysis × 500.
  c. One spore × 1200.
  d. Ascus to show operculum × 1000.

II. GALACTINIA SUCCOSA (Berk.) Sacc.
  a. Several cups natural size.
  b. Ascus and paraphysis × 500.
  c. One spore showing markings × 1500.
  d. Diagram section natural size.

PLATE 16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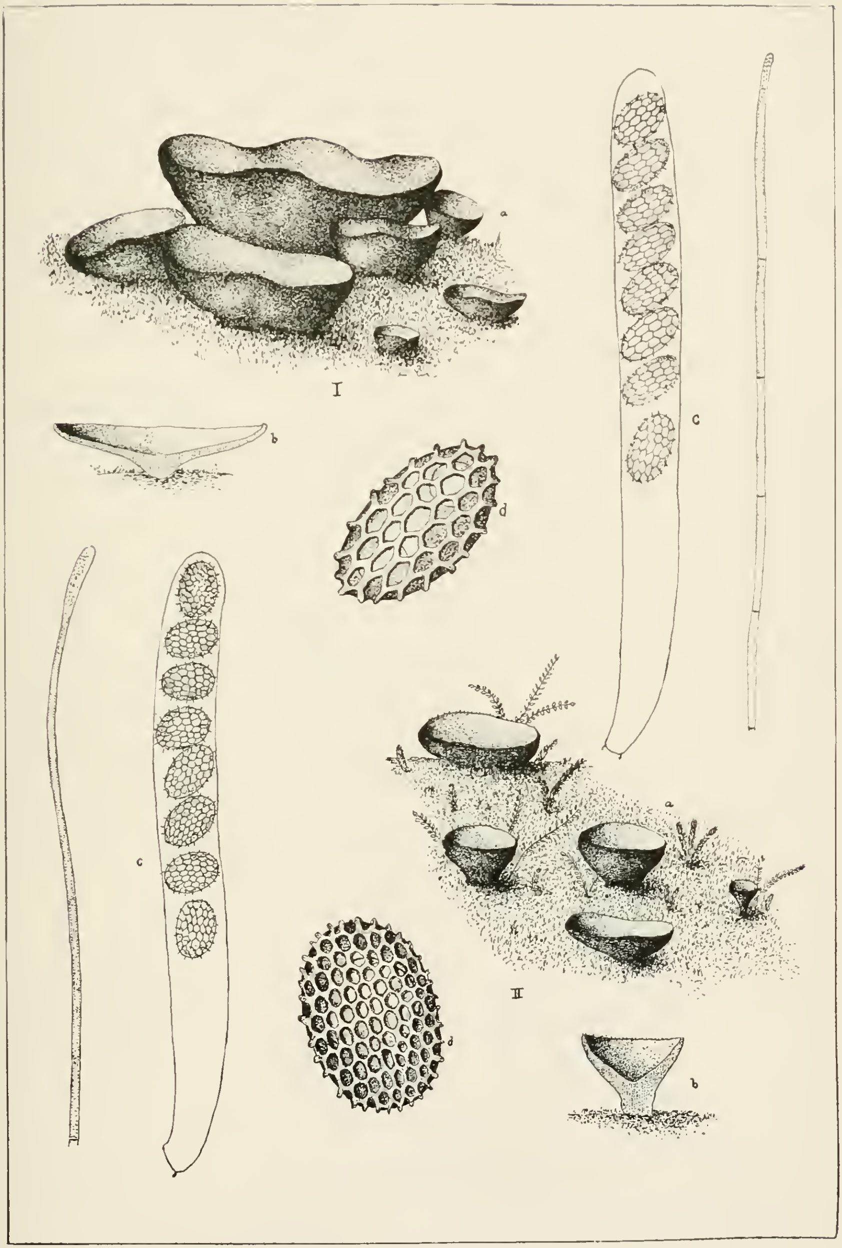
a
II
c
d

Explanation of Plate 17

I. Aleuria aurantia (Pers.) Fuckel.
  - a. Group of plants natural size.
  - b. Diagram section natural size.
  - c. Ascus and paraphysis × 600.
  - d. One spore showing markings × 1800.

II. Aleuria rutilans (Fries) Gill.
  - a. Cups showing habitat × 2.
  - b. Diagram section × 2.
  - c. Ascus with paraphysis × 500.
  - d. One spore showing markings × 1500.

Plate 17


a
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a
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d
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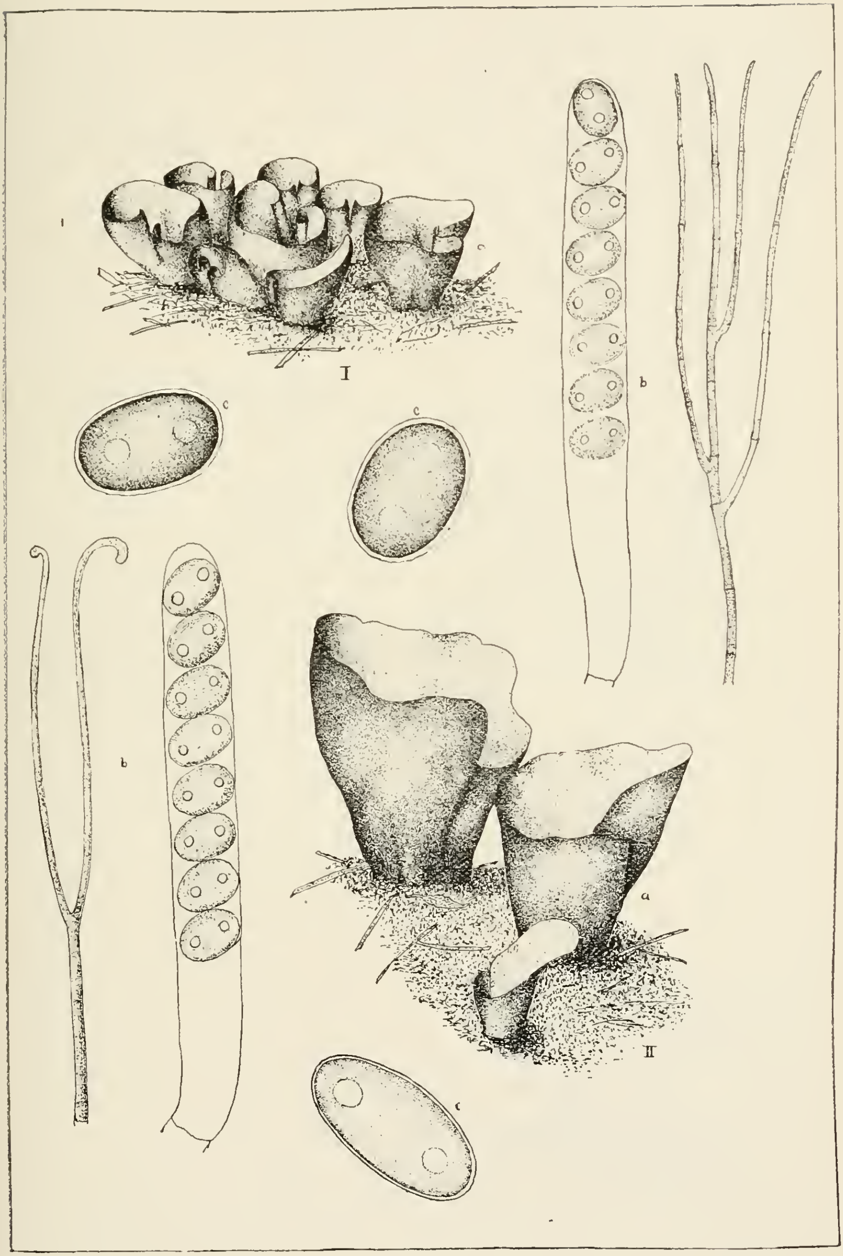
EXPLANATION OF PLATE 18

I. OTIDEA ONOTICA OCHRACEA (Fries) Sacc.
- a. Several plants natural size.
- b. Ascus and paraphysis × 800.
- c. Spores × 2000.

II. OTIDEA LEPORINA (Batsch) Fuckel.
- a. Plants natural size.
- b. Ascus and paraphysis × 700.
- c. One spore × 2000.

PLATE 18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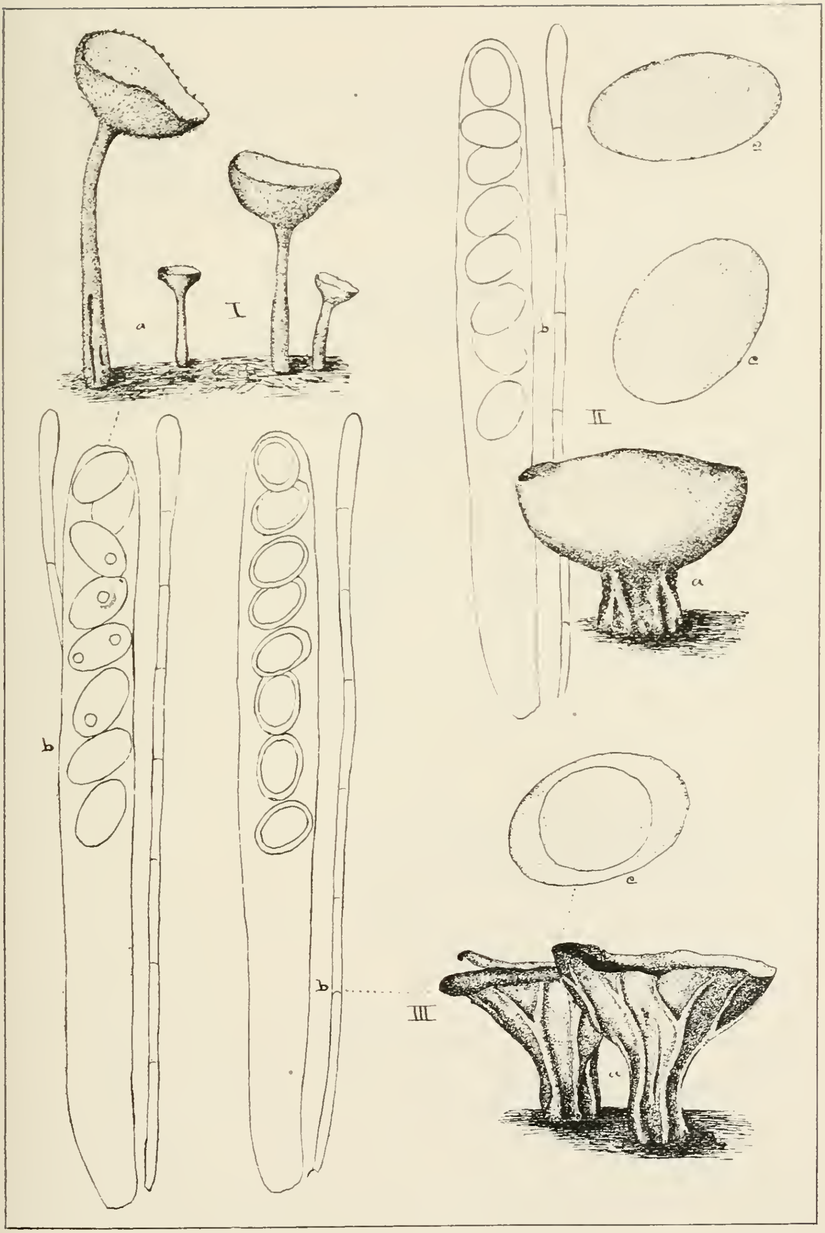
EXPLANATION OF PLATE 19

I. MACROPODIA MACROPUS (Pers.) Fuckel.
- a. Plants of different ages natural size.
- b. Ascus with paraphyses and spores × 300.
- c. One spore × 800.

II. ACETABULA SULCATA (Pers.) Fuckel.
- a. One plant natural size.
- b. Ascus with paraphysis and spores × 400.
- c. One spore × 1200.

III. ACETABULUM ACETABULUM (L.) comb. nov.
- a. Two plants natural size.
- b. Ascus with paraphysis and spores × 500.
- c. One spore × 1200.

PLATE 19


a
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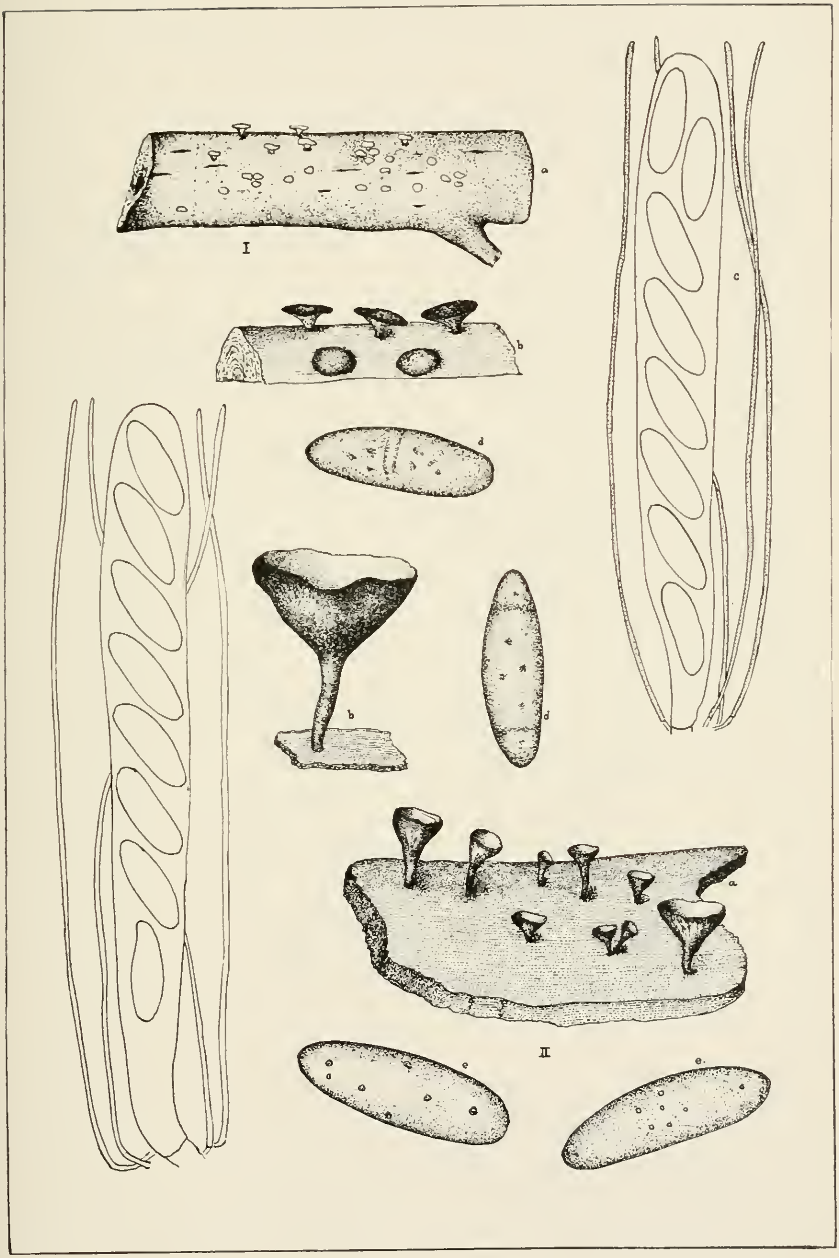
II
2
c
a
e
III
a

EXPLANATION OF PLATE 20

I. HELOTIUM CITRINUM (Hedw.) Fries.
  a. Group of plants to show habitat natural size.
  b. Plants enlarged × 3.
  c. Ascus and paraphyses × 1500.
  d. Spore × 2000.

II. GEOPYXIS NEBULOSA (Cooke) Sacc.
  a. Group of plants to show habitat natural size.
  b. One plant × 3.
  c. Ascus and paraphyses × 500.
  d. Spores × 800.

PLATE 20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d
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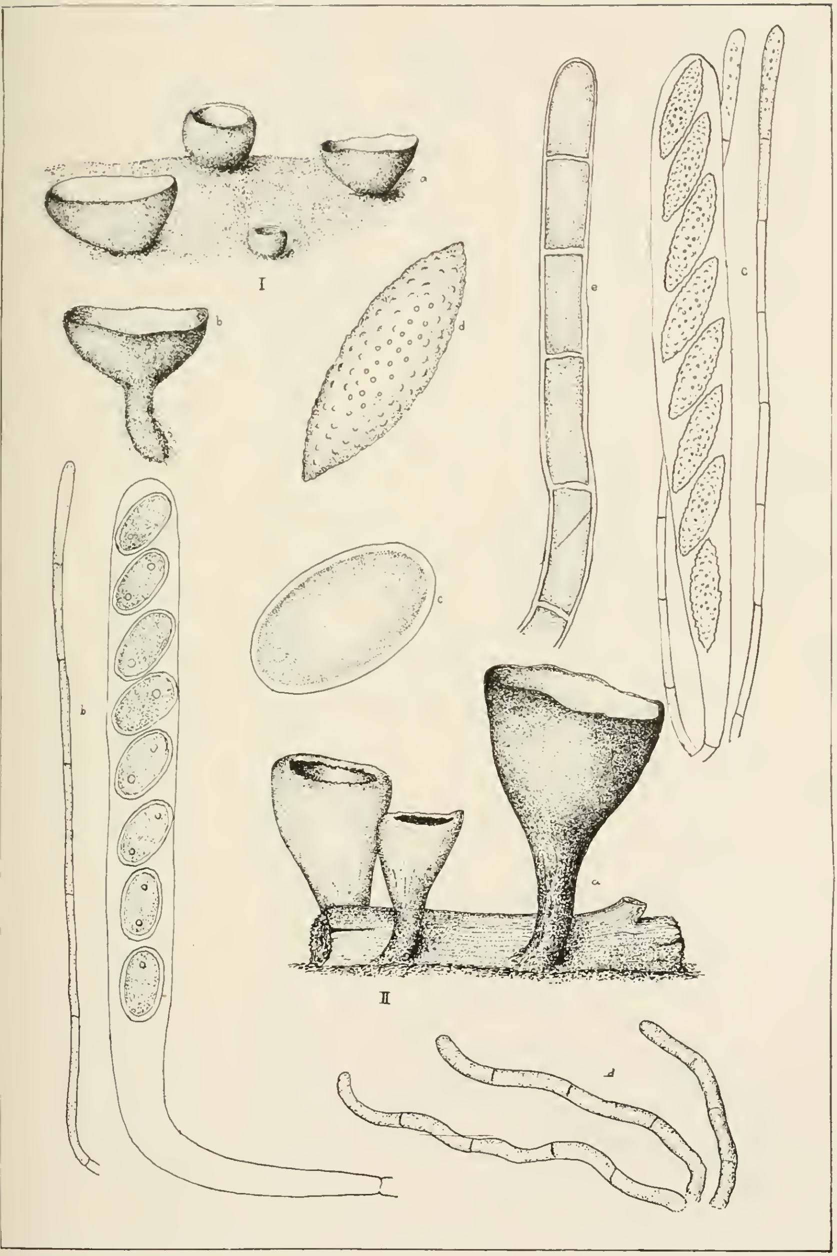
II
e
e.

EXPLANATION OF PLATE 21

I. MACROPODIA FUSICARPE (Ger.) Durand.
  - a. Several plants natural size.
  - b. One plant removed to show stem-like base.
  - c. Ascus and paraphyses × 400.
  - d. One spore showing markings × 1000.
  - e. Portion of hair × 700.

II. SARCOSCYPHA COCCINEA (Scop.) Sacc.
  - a. Plants to show habitat natural size.
  - b. Ascus and paraphysis × 400.
  - c. One spore × 1000.
  - d. Hair × 1400.

PLATE 21



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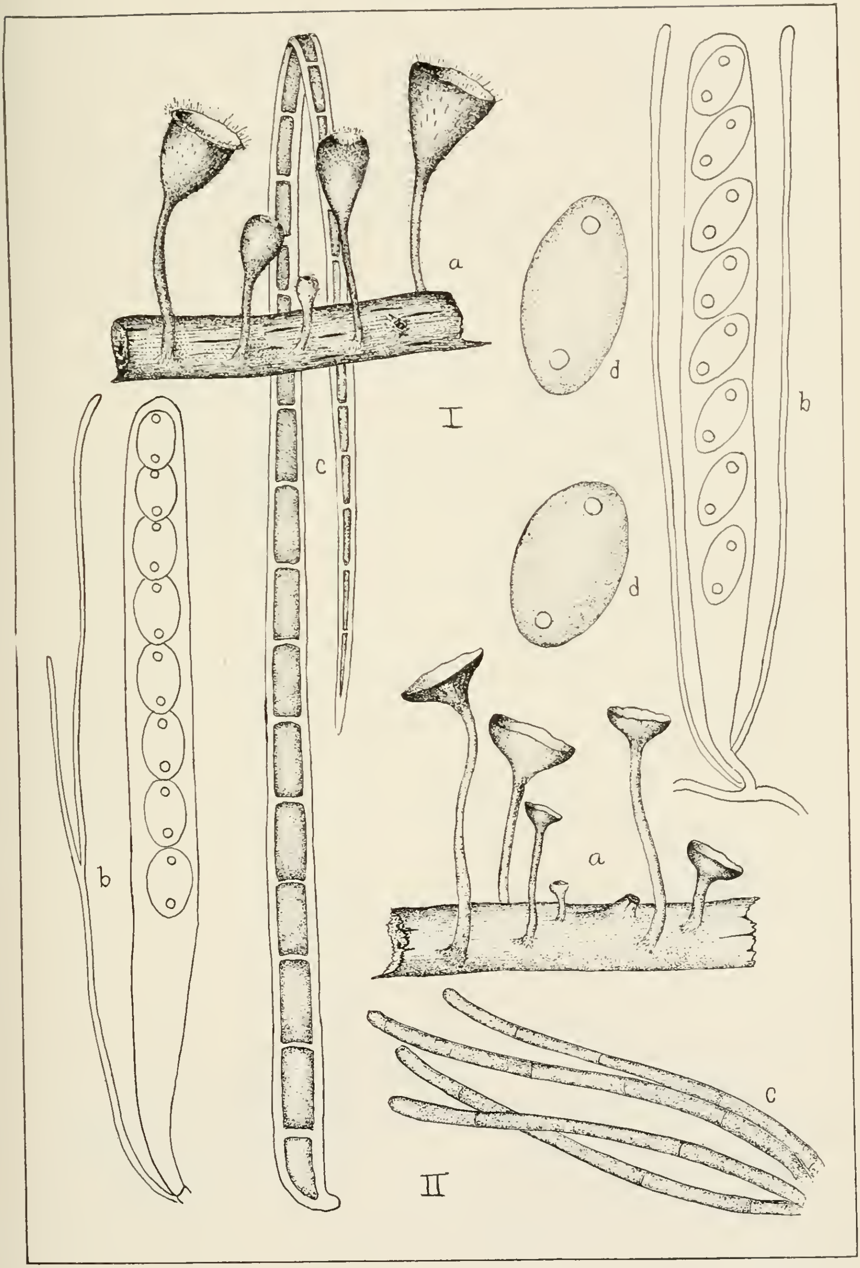
a
II
d

EXPLANATION OF PLATE 22

I. SARCOSCYPHA FLOCCOSA (Schw.) Sacc.
  - a. Several cups showing habitat natural size.
  - b. Ascus with paraphyses × 500.
  - c. One hair removed × 500.
  - d. One spore × 1000.

II. SARCOSCYPHA OCCIDENTALIS (Schw.) Sacc.
  - a. Cups showing habitat natural size.
  - b. Ascus with paraphysis × 500.
  - c. Hairs × 500.
  - d. One spore × 1000.

PLATE 22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c
II

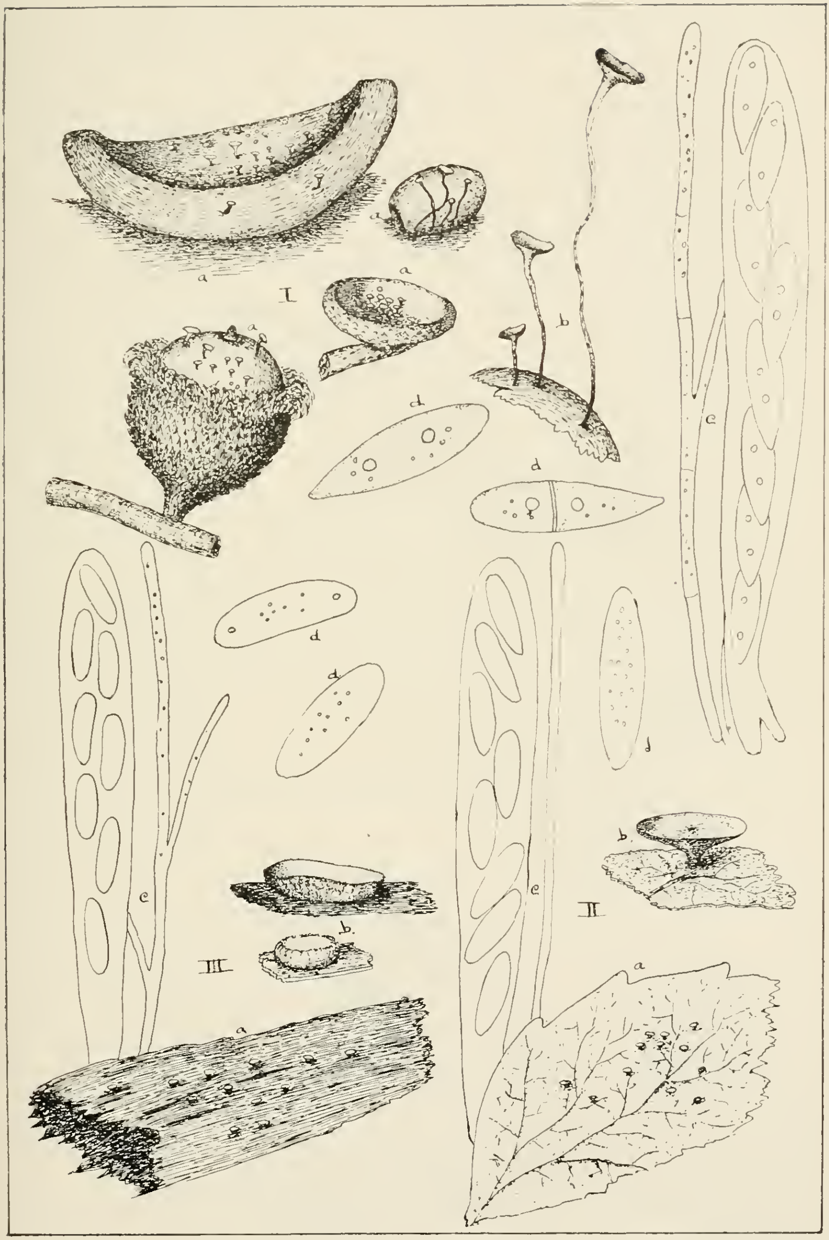
EXPLANATION OF PLATE 23

I. PHIALEA FRUCTIGENA (Bull.) Gill.
  - a. Plants natural size showing substrata.
  - b. Several plants × 5.
  - c. Ascus with spores and paraphysis × 1000.
  - d. Spores × 2000.

II. HELOTIUM FRIESII (Weim.) Sacc.
  - a. Plants natural size.
  - b. One plant × 10.
  - c. Ascus with spores and paraphysis × 1500.
  - d. One spore × 3000.

III. CHLOROSPLENIUM CHLORA (Schw.) Massee.
  - a. Plants natural size.
  - b. Two plants × 10.
  - c. Ascus with paraphysis and spores × 2000.
  - d. Two spores × 4000.

PLATE 23



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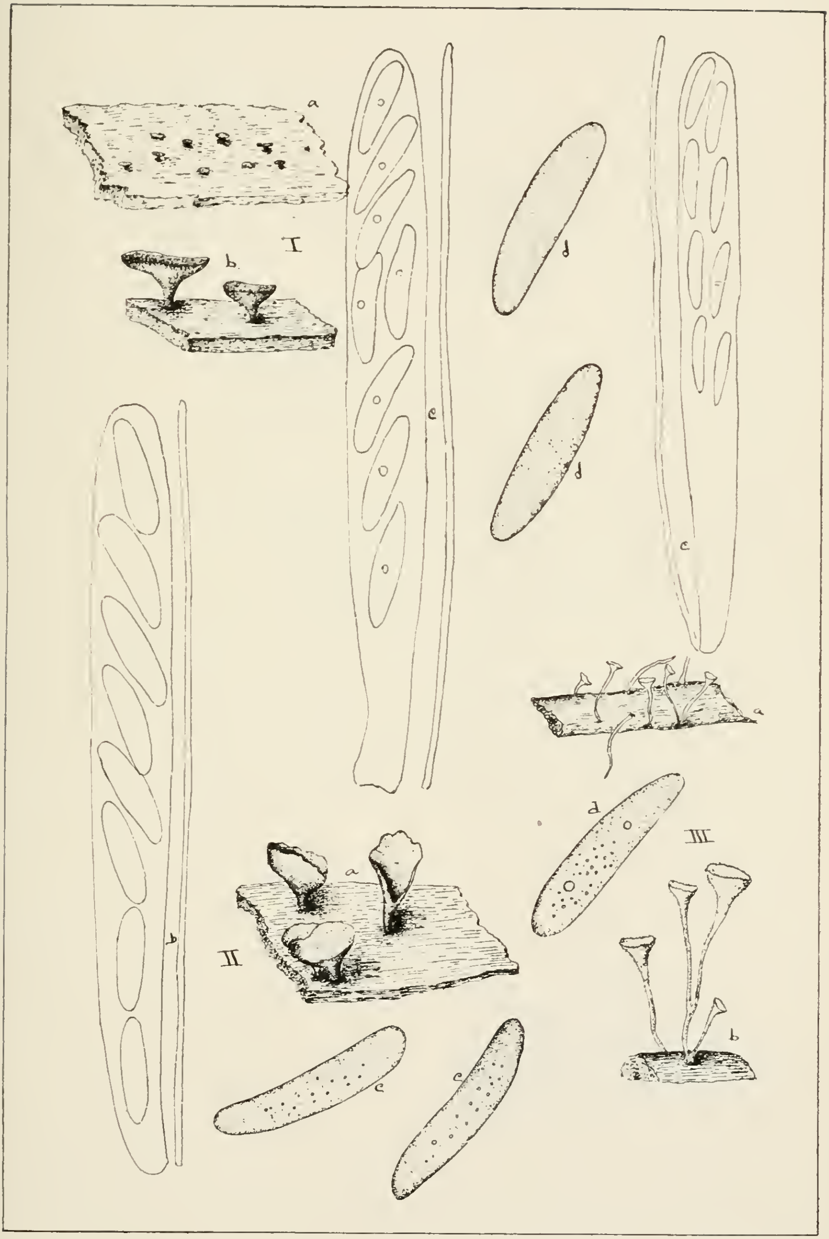
EXPLANATION OF PLATE 24

I. CHLOROSPLENIUM ÆRUGINOSUM (Œder) DeNotaris.
  a. Plants natural size.
  b. Two plants × 5.
  c. Ascus with paraphysis and spores × 1500.
  d. Spores × 3000.

II. CHLOROSPLENIUM VERSIFORME (Pers.) DeNotaris.
  a. Plants about natural size.
  b. Ascus with paraphysis and spores × 2000.
  c. Spores × 4000.

III. DASYSCYPHA PYGMÆA (Fries) Sacc.
  a. Plants natural size.
  b. Several plants × 3.
  c. Ascus with paraphysis and spores × 1000.
  d. One spore × 3000.

PLATE 24


a
I
b.
c
d
d
c
a
b
d
III
a
II
b
c
c
b

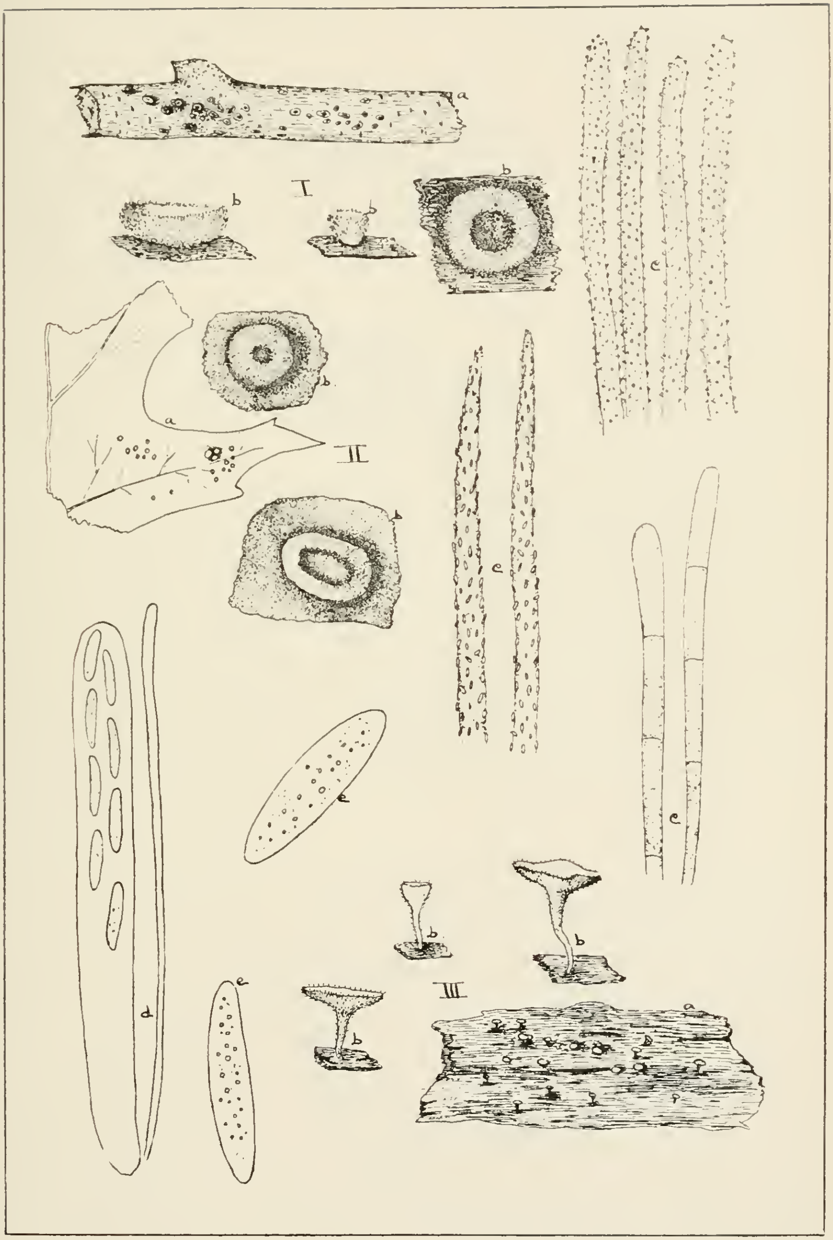
Explanation of Plate 25

Trichopeziza tiliæ (Peck) Sacc.
a. Plants natural size.
b. Plants of different ages × 10.
c. Hairs from exterior of cups showing markings.

II. Trichopeziza comata (Schw.) Sacc.
a. Plants natural size.
b. Two plants × 10.
c. Hairs from exterior of cup.

III. Dasyscypha nivea (Hedw.) Sacc.
a. Plants natural size.
b. Several plants × 10.
c. Hairs from exterior of cups.
d. Ascus with paraphyses and spores × 1000.
e. Spores × 3000.

PLATE 25

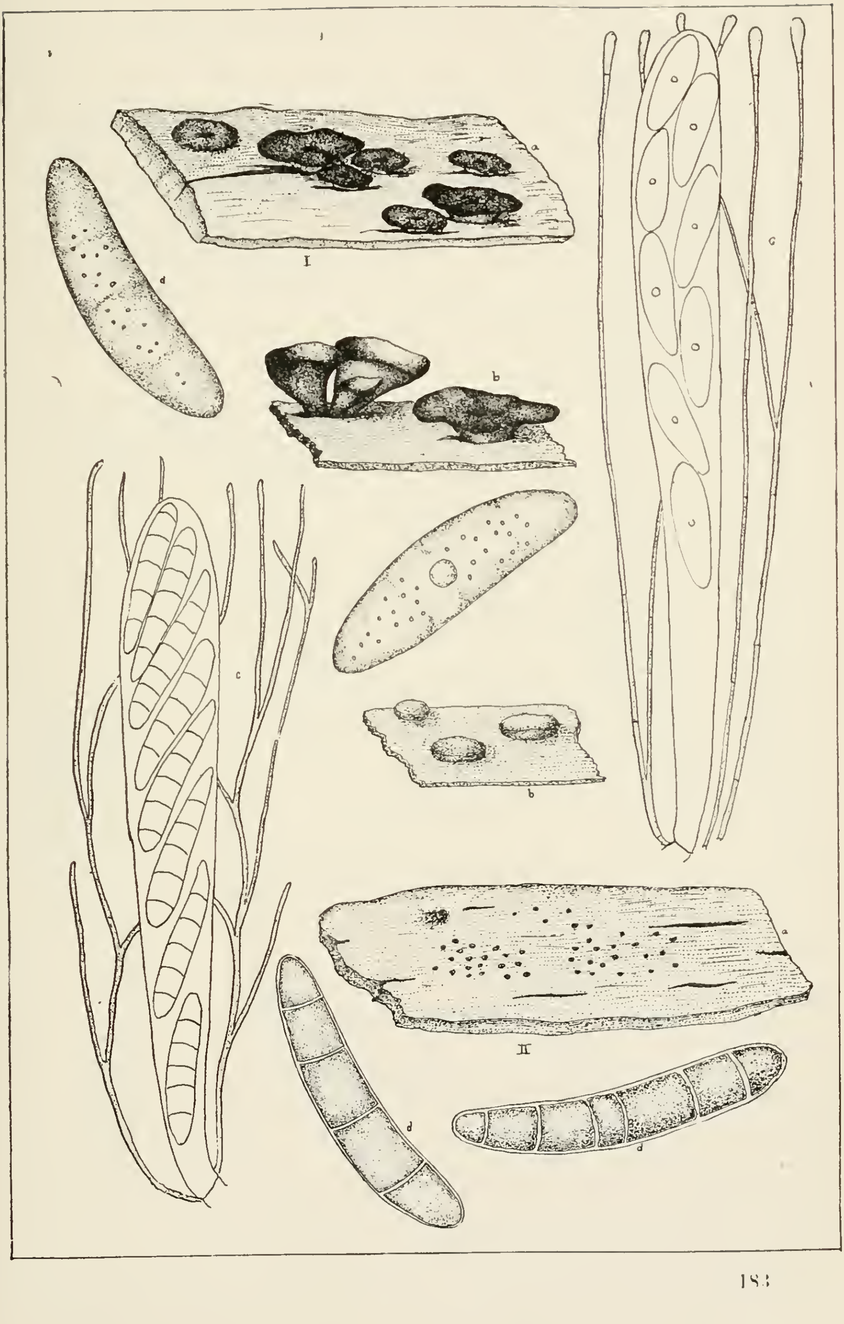

a
I
b
b
b
c
II
a
b
b
c
c
d
e
e
b
b
III
b
a

EXPLANATION OF PLATE 26

I. CORYNE SARCOIDES (Jacq.) Tul.
  a. Plants showing habitat natural size.
  b. Plants a little enlarged.
  c. Ascus and paraphyses × 1000.
  d. Spores × 2000.

II. GORGONICEPS IOWENSIS Rehm.
  a. Plants showing habitat natural size.
  b. Several plants × 10.
  c. Ascus and paraphyses × 1000.
  d. Two spores × 2000.

PLATE 26

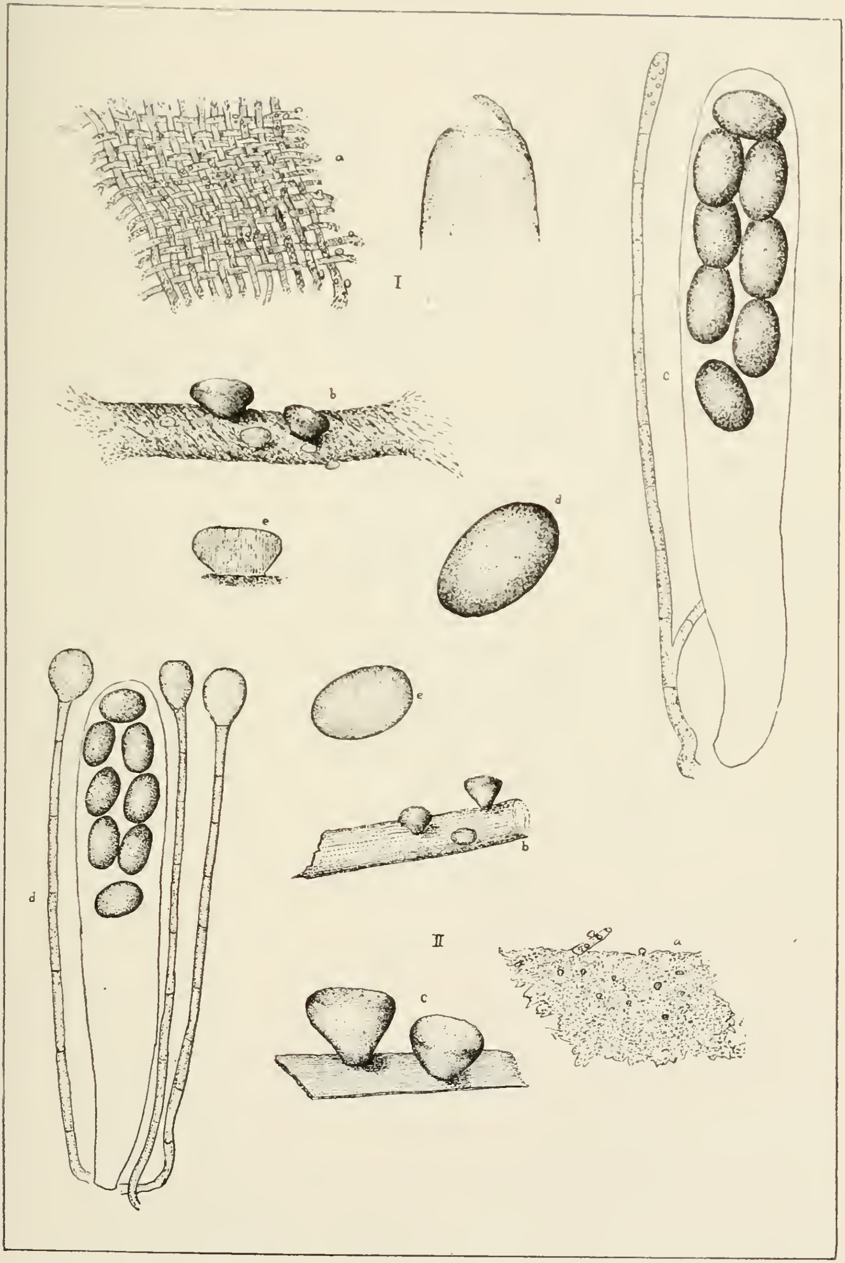

a
I
d
b
c
c
b
a
II
d
d

EXPLANATION OF PLATE 27

1. ASCOPHANUS TESTACEUS (Moug.) Phill.
    a. Plants showing habitat natural size.
    b. Several plants × 10.
    c. Ascus and paraphyses × 600.
    d. One spore × 1200.
    e. Diagram section × 10.

II. ASCOPHANUS MICROSPORUS (Berk. & Br.) Phill.
    a. Several plants natural size.
    b. Plants × 10.
    c. Two plants × 20.
    d. Ascus and paraphyses × 1000.
    e. One spore × 2000.

PLATE 27

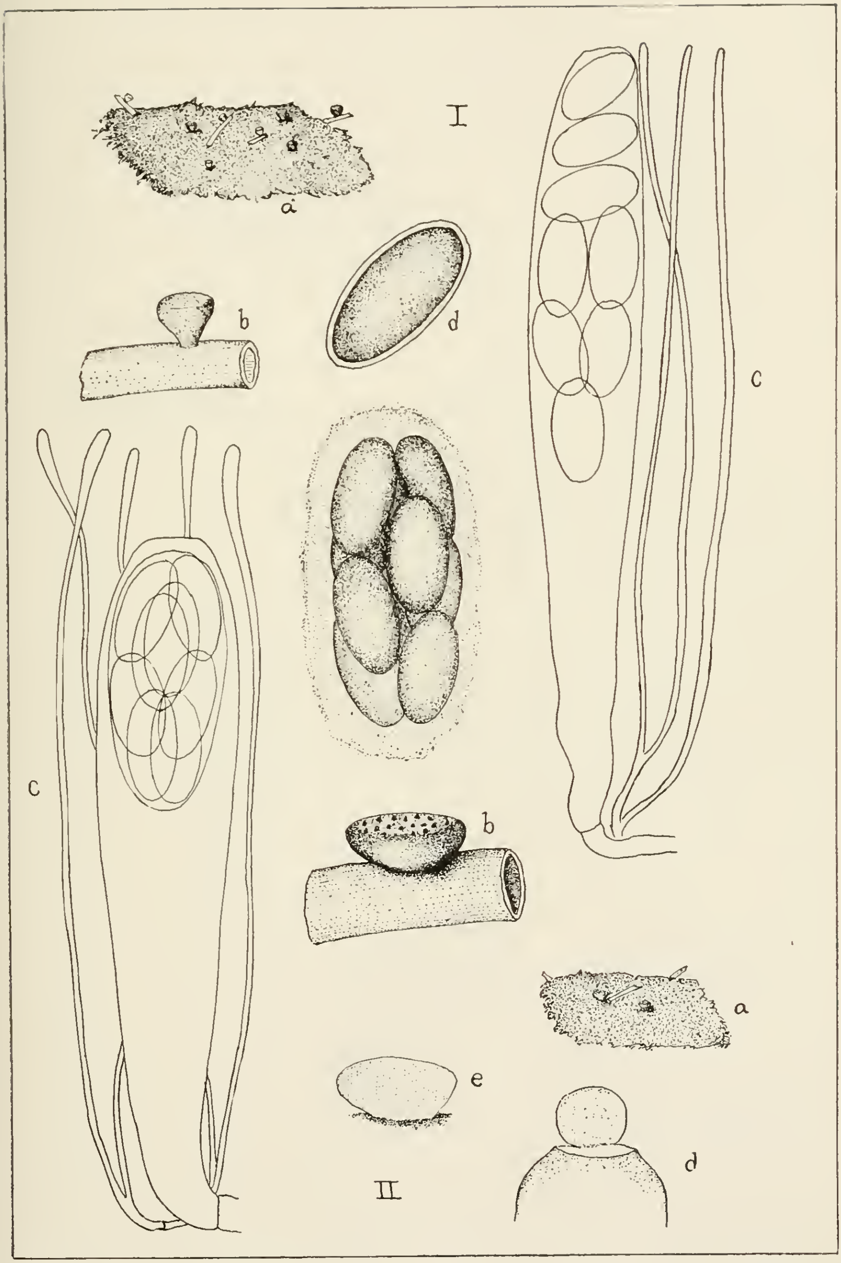

a
I
b
c
e
d
d
e
b
II
a
c

EXPLANATION OF PLATE 28

I. ASCOPHANUS CINEREUS (Crouan) Boud.
- a. Plants natural size.
- b. One plant × 10.
- c. Ascus and paraphysis × 700.
- d. One spore × 1200.

II. SACCOBOLUS KERVERNI (Crouan) Boud.
- a. Plants a little enlarged.
- b. One plant × 25.
- c. Ascus and paraphyses × 800.
- d. Ascus to show operculum × 800.
- e. Diagram section × 25.

PLATE 28



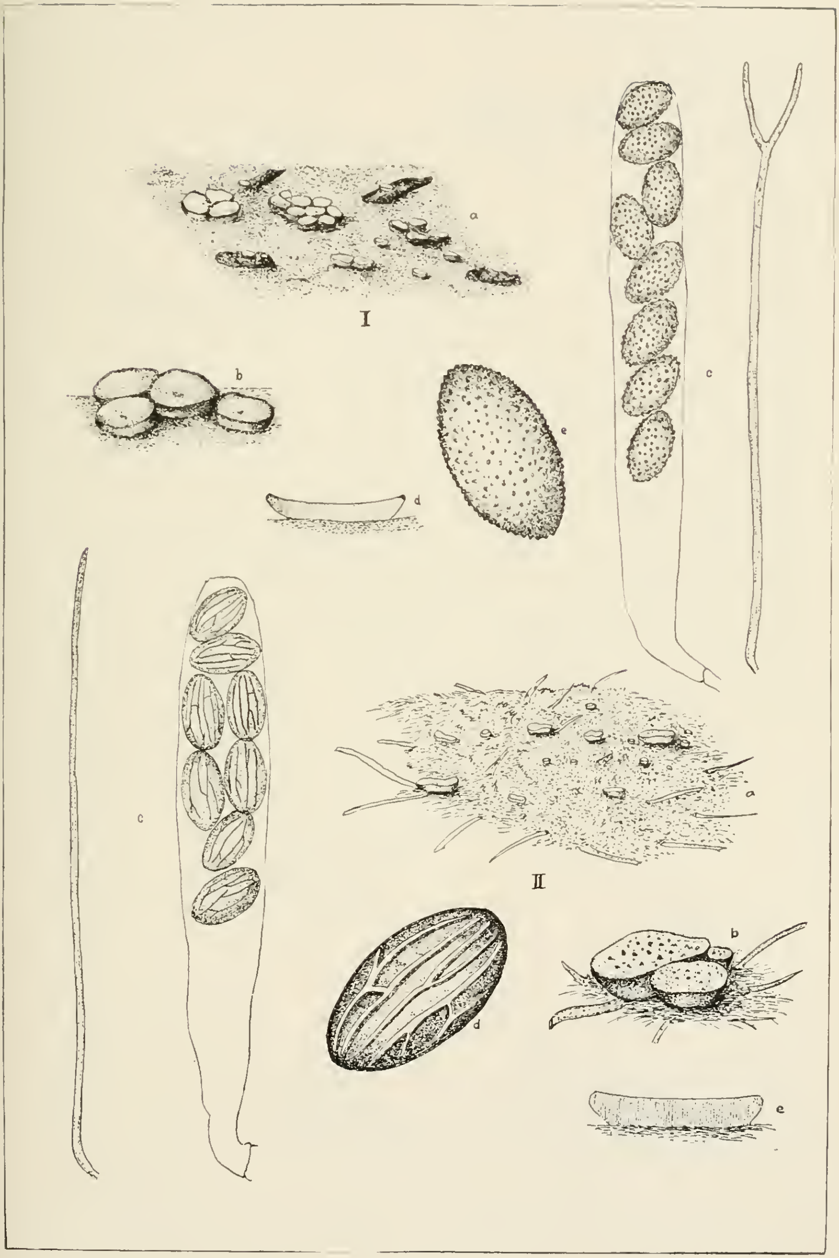
I
a
b
d
c
c
b
a
e
d
II

EXPLANATION OF PLATE 29

I. ASCOBOLUS CARBONARIUS Karst.
  - a. Group of plants showing habitat natural size.
  - b. Several plants × 2.
  - c. Ascus and paraphyses × 500.
  - d. Diagram section × 4.
  - e. One spore showing markings × 1200.

II. ASCOBOLUS STERCORARIUS (Bull.) Schroet.
  - a. Group of plants natural size.
  - b. Plants showing projecting asci × 3.
  - c. Ascus and paraphysis × 400.
  - d. One spore showing markings × 1200.
  - e. Diagram section × 5.

Plate 29



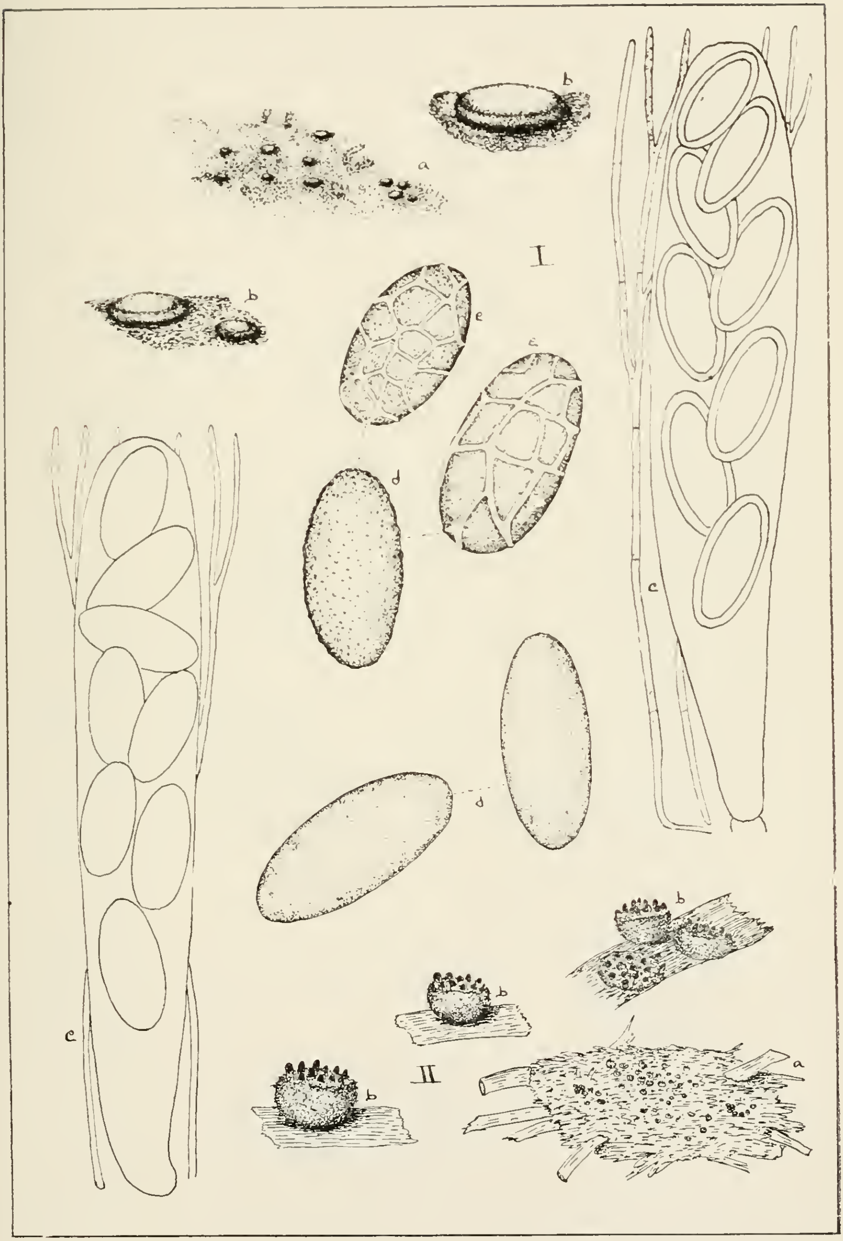
a
I
b
c
e
d
c
a
II
b
d
e

EXPLANATION OF PLATE 30

I. ASCOBOLUS VIRIDIS Curr.
  - a. Plants natural size.
  - b. Plants × 5.
  - c. Ascus with spores and paraphyses × 800.
  - d. One spore not fully mature × 1200.
  - e. Mature spores × 1200.

II. ASCOBOLUS LEVEILLEI Boud.
  - a. Plants natural size.
  - b. Several plants × 10.
  - c. Ascus with spores and paraphyses × 800.
  - d. Two spores × 1500.

Plate 30

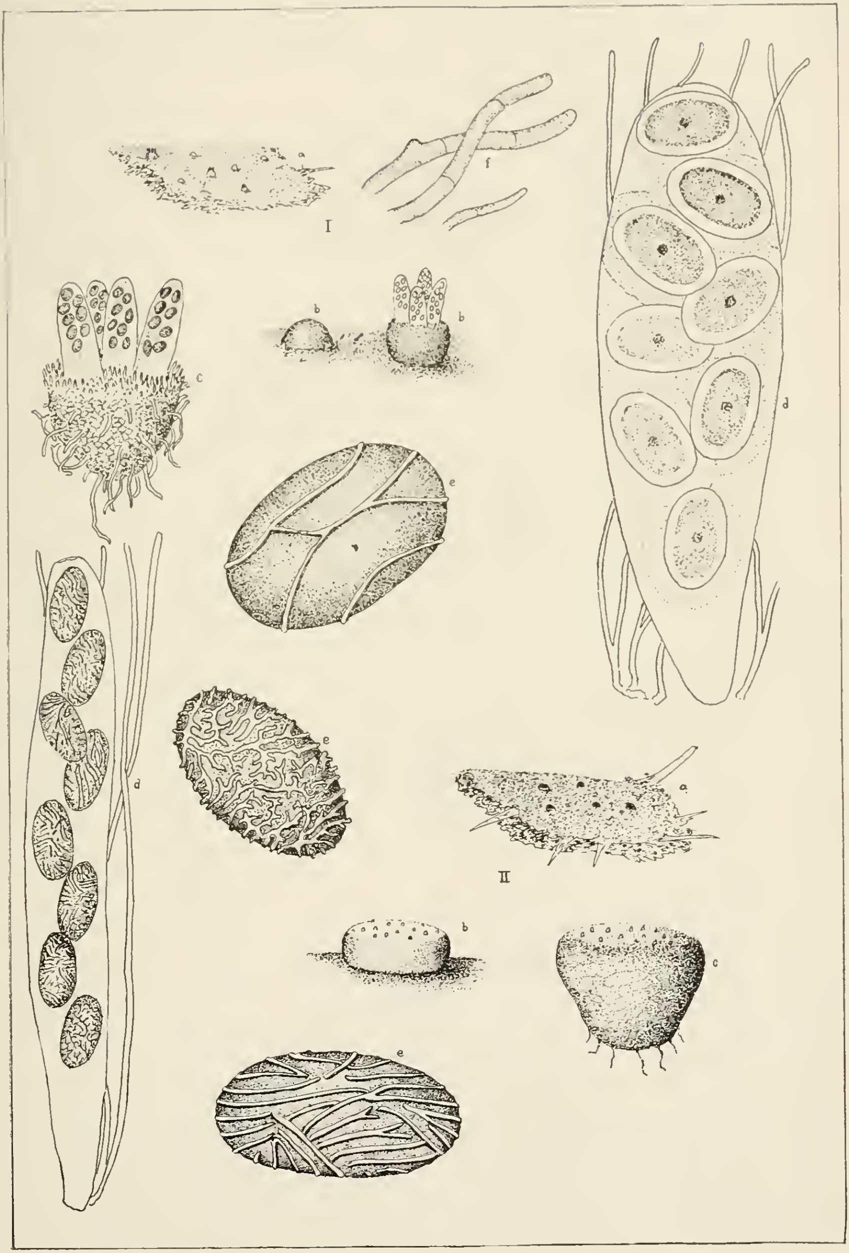

b
a
I
b
e
e
d
c
d
c
b
b
II
b
a

EXPLANATION OF PLATE 31

I. ASCOBOLUS IMMERSUS Pers.
  a. Several plants natural size.
  b. Mature and immature plants × 5.
  c. Mature plant × 25.
  d. Ascus with spores and paraphyses just before maturity × 300.
  e. Mature spores showing markings × 600.

II. ASCOBOLUS GLABER Pers.
  a. Several plants natural size.
  b. Mature plant with projecting asci × 20.
  c. Same as preceding removed from substratum.
  d. Ascus with mature spores and paraphyses × 400.
  e. Mature spores showing markings × 1200.

PLATE 31

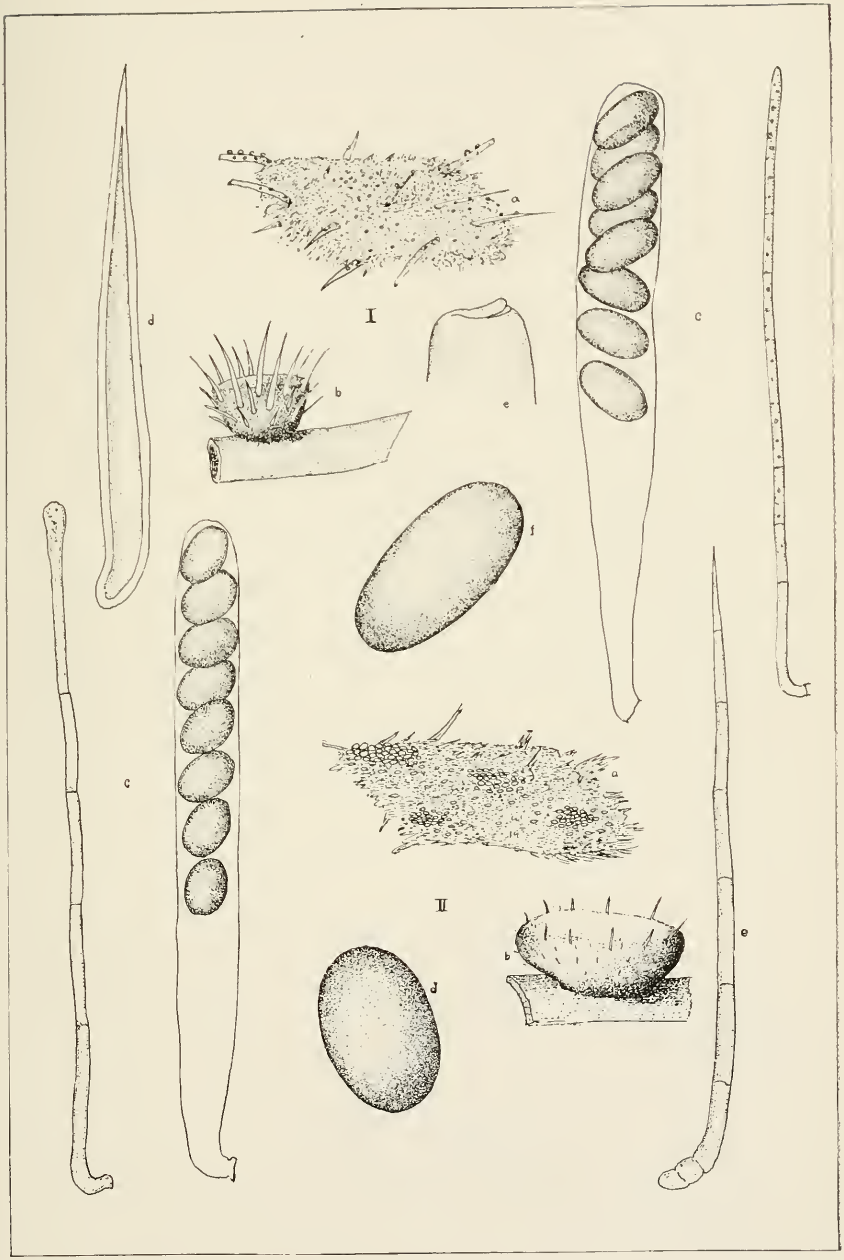

a
f
I
b
b
c
d
e
e
d
a
II
b
c
e

EXPLANATION OF PLATE 32

I. LASIOBOLUS EQUINUS (Muell.) Karst.
  - a. Several plants showing habitat natural size.
  - b. One plant showing spines × 20.
  - c. Ascus and paraphysis × 500.
  - d. One spine × 500.
  - e. Ascus to show operculum.
  - f. One spore × 1200.

II. LASIOBOLUS RARIPILUS (Phill.) Sacc.
  - a. Group of plants natural size.
  - b. One plant with spines diagramatic × 10.
  - c. Ascus and paraphysis × 400.
  - d. One spore × 1200.
  - e. Hair from exterior of plant × 500.

PLATE 32

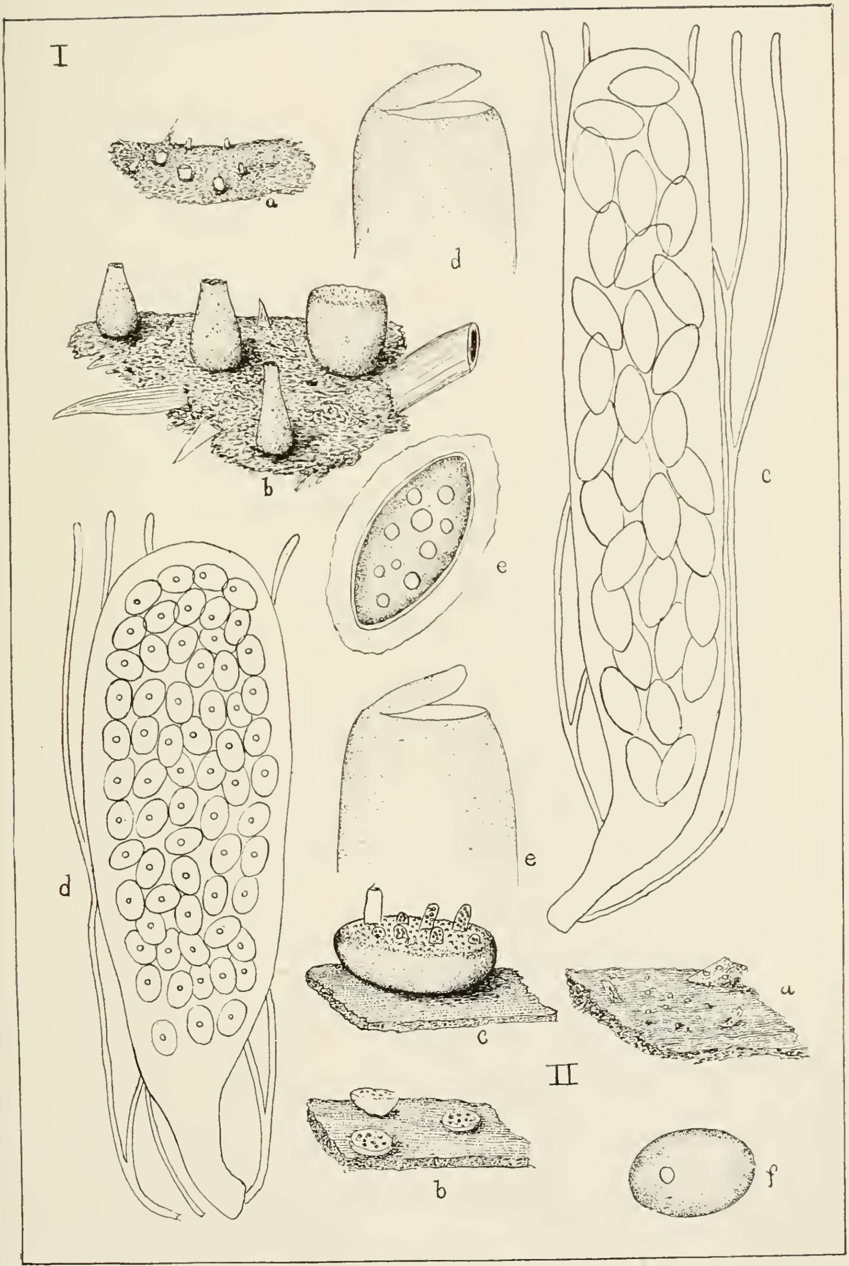

a
d
I
c
b
e
f
c
a
II
e
b
d

EXPLANATION OF PLATE 33

I. THECOTHEUS PELLETIERI (Crouan) Sacc.
  a. Several plants natural size.
  b. Mature and immature cups × 10.
  c. Ascus and paraphyses × 400.
  d. Ascus to show operculum × 400.
  e. One spore with membrane × 1000.

II. RHYPAROBIUS CRUSTACEUS (Fuckel) Rehm.
  a. Plants about natural size.
  b. Plants × 10.
  c. One plant to show projecting asci × 30.
  d. Ascus and paraphyses × 1000.
  e. Ascus to show operculum × 800.

PLATE 33



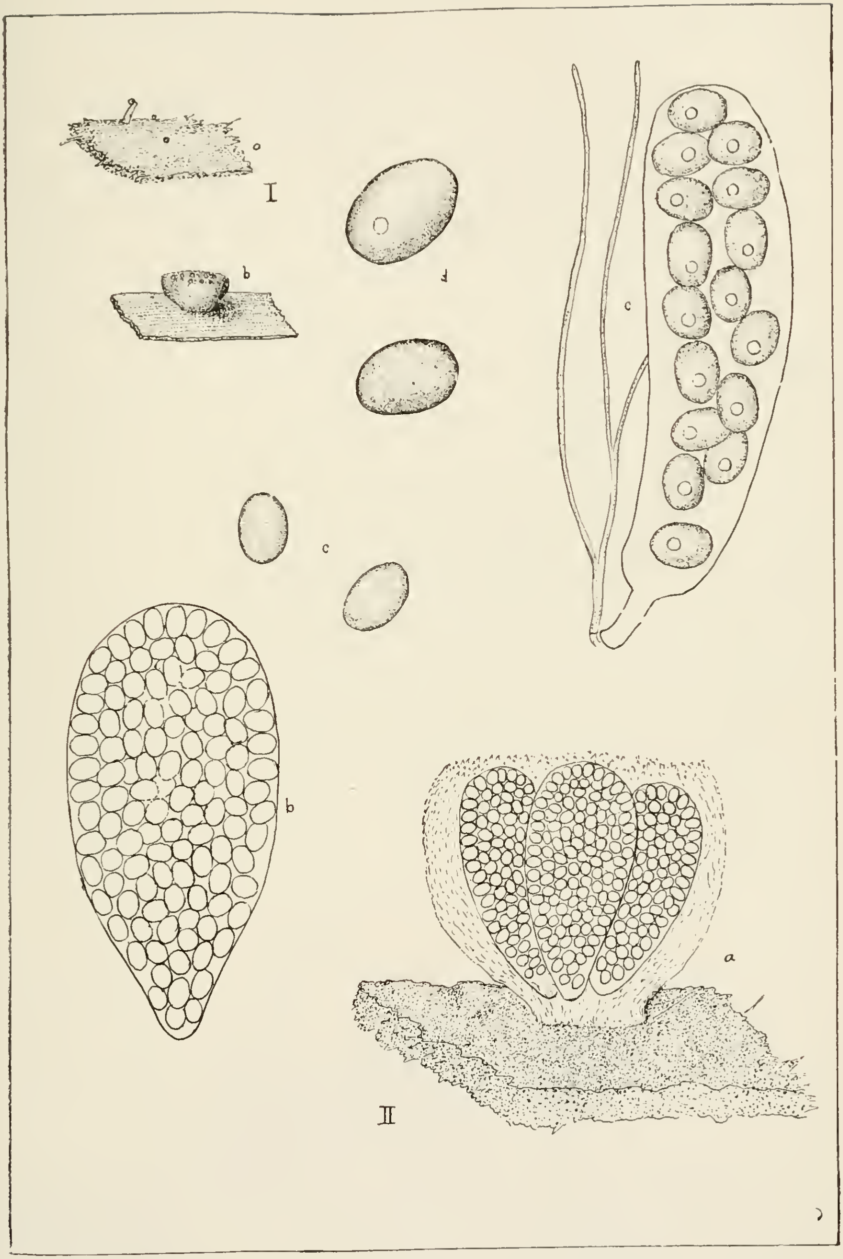
I
a
d
b
c
e
d
e
c
a
II
b
f

EXPLANATION OF PLATE 34

I. RHYPAROBIUS SEXDECIMSPOROS (Crouan) Sacc.
- a. Plants natural size.
- b. One plant × 20.
- c. Ascus and paraphyses × 1000.
- d. Spores × 1500.

II. RHYPAROBIUS PACHYASCUS Zukal.
- a. Diagram section × 500.
- b. Ascus with spores × 1000.
- c. Spores × 2000.

PLATE 34

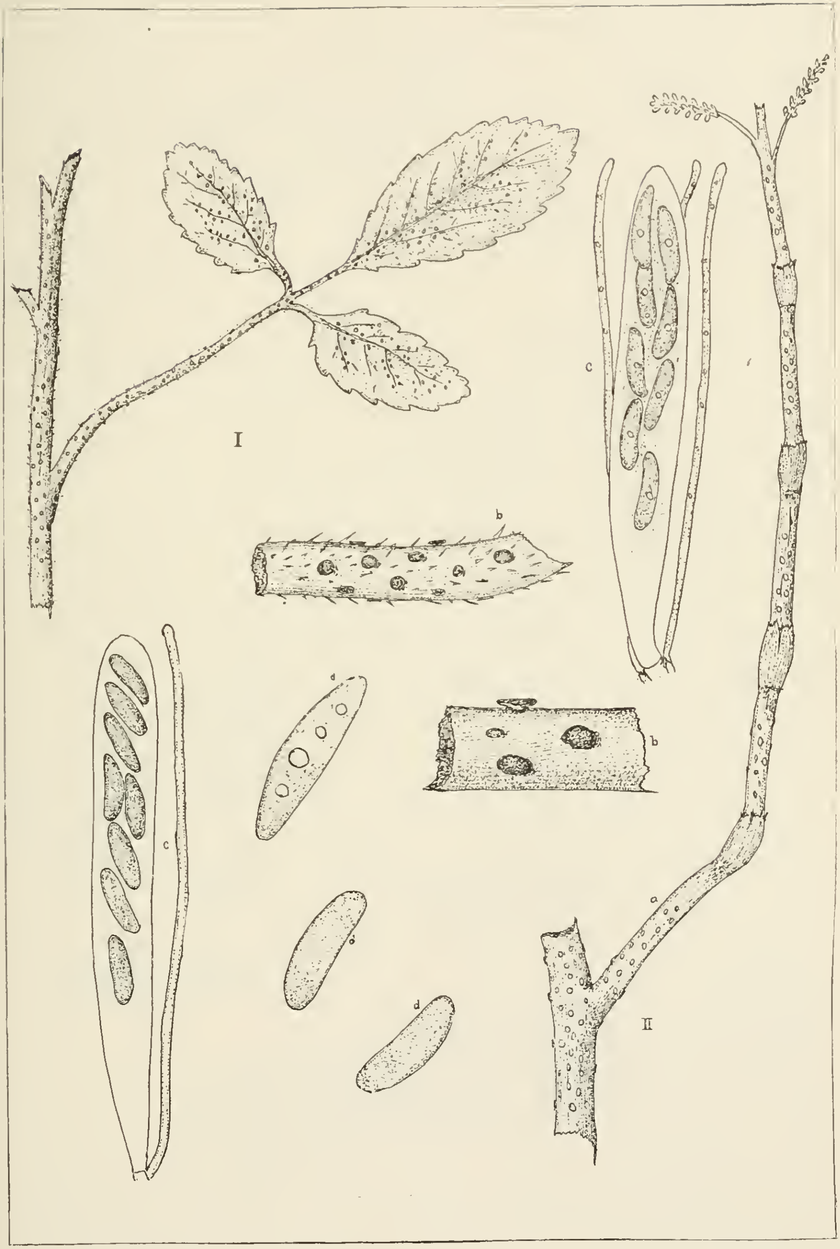

a
I
b
d
c
c
b
a
II

EXPLANATION OF PLATE 35

I. MOLLISIA DEHNII (Rabenh.) Karst.
  a. Plants showing habitat natural size.
  b. Several plants × 3.
  c. Ascus and paraphyses × 1000.
  d. One spore × 2500.

II. MOLLISIA POLYGONI (Lasch.) Gill.
  a. Plants showing habitat natural size.
  b. Several plants × 5.
  c. Ascus and paraphyses × 1200.
  d. Two spores × 2500.

PLATE 35


I
b
c
c
d
b
d
d
a
II

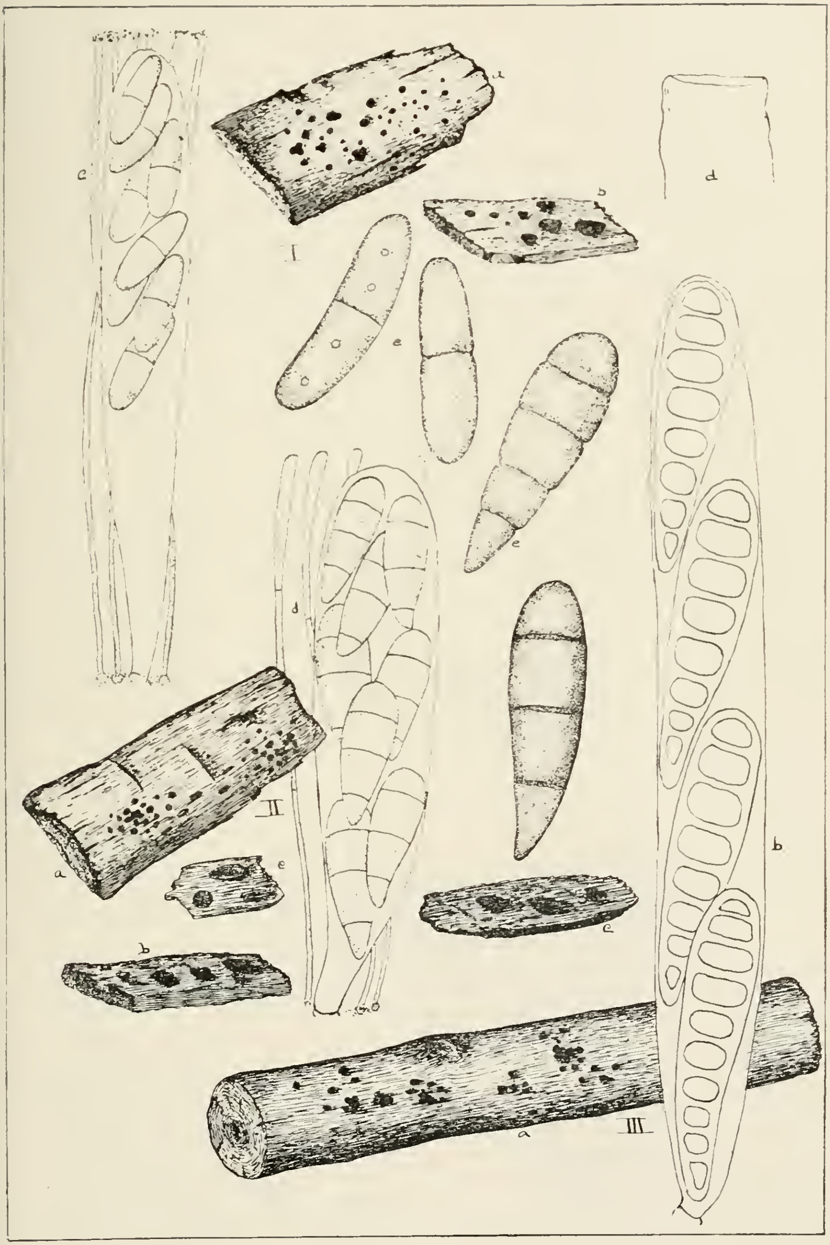
EXPLANATION OF PLATE 36

I. KARSCHIA TAVELIANA Rehm.
  a. Plants natural size.
  b. Plants a little enlarged.
  c. Ascus with paraphyses and spores × 800.
  d. Portion of an empty ascus × 1000.
  e. Two spores × 1800.

II. HYSTEROPATELLA CLAVISPORA (Peck) comb. nov.
  a. Plants natural size.
  b. Plants a little enlarged.
  c. Several plants showing different forms × 5.
  d. Ascus with paraphyses and spores × 800.
  e. Two spores × 1500.

III. PATELLARIA TETRASPORA Massee & Morgan.
  a. Plants natural size.
  b. Ascus with spores × 1000.
  c. Plants × 3.

Plate 36

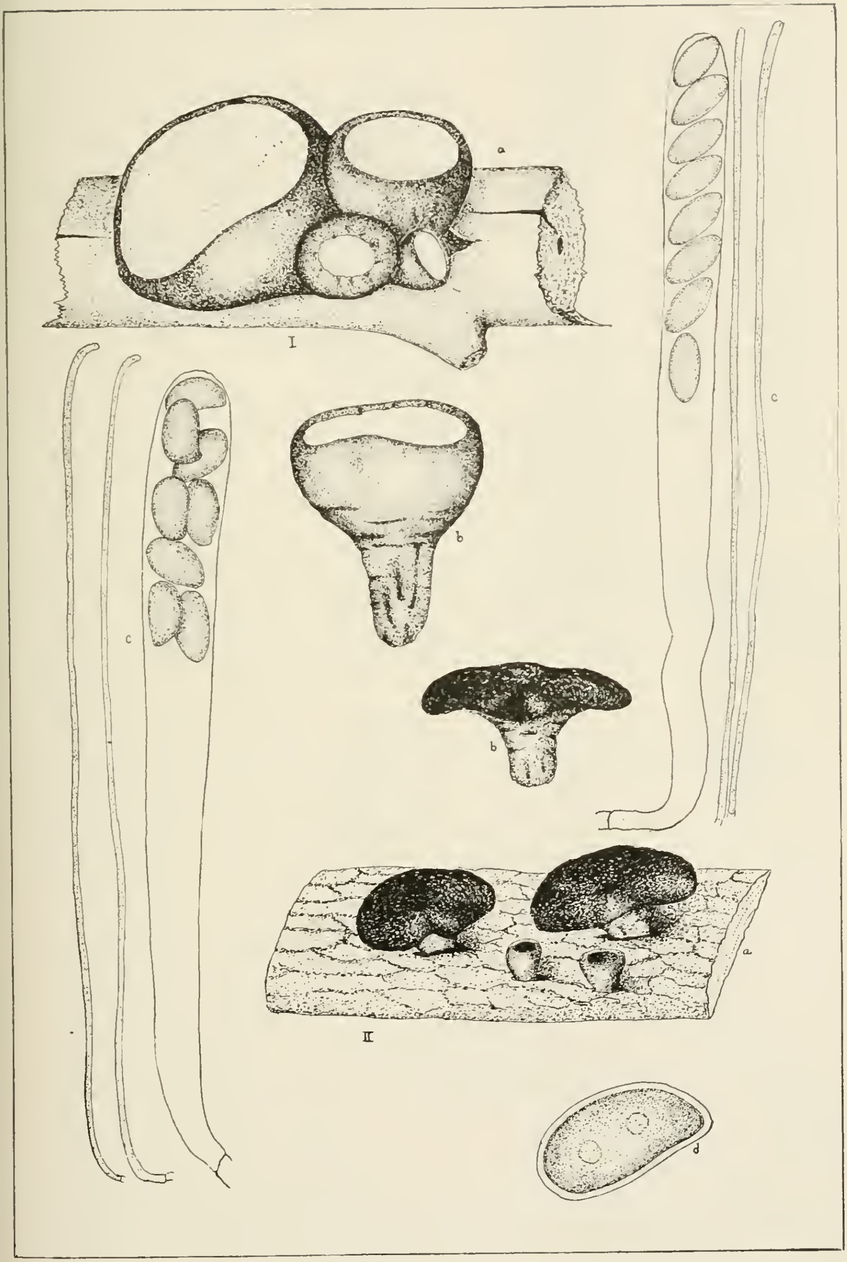

a
c
d
b
I
e
e
d
b
II
a
e
b
c
III
a

EXPLANATION OF PLATE 37

I. SARCOSOMA RUFA (Schw.) Rehm.
  a. Cluster of plants showing habitat natural size.
  b. One cup removed showing stem natural size.
  c. Ascus with spores and paraphyses × 500.

II. BULGARIA INQUINANS (Pers.) Fries.
  a. Young and mature plants showing habitat natural size.
  b. One plant removed showing stem.
  c. Ascus and paraphyses × 750.
  d. One spore × 2000.

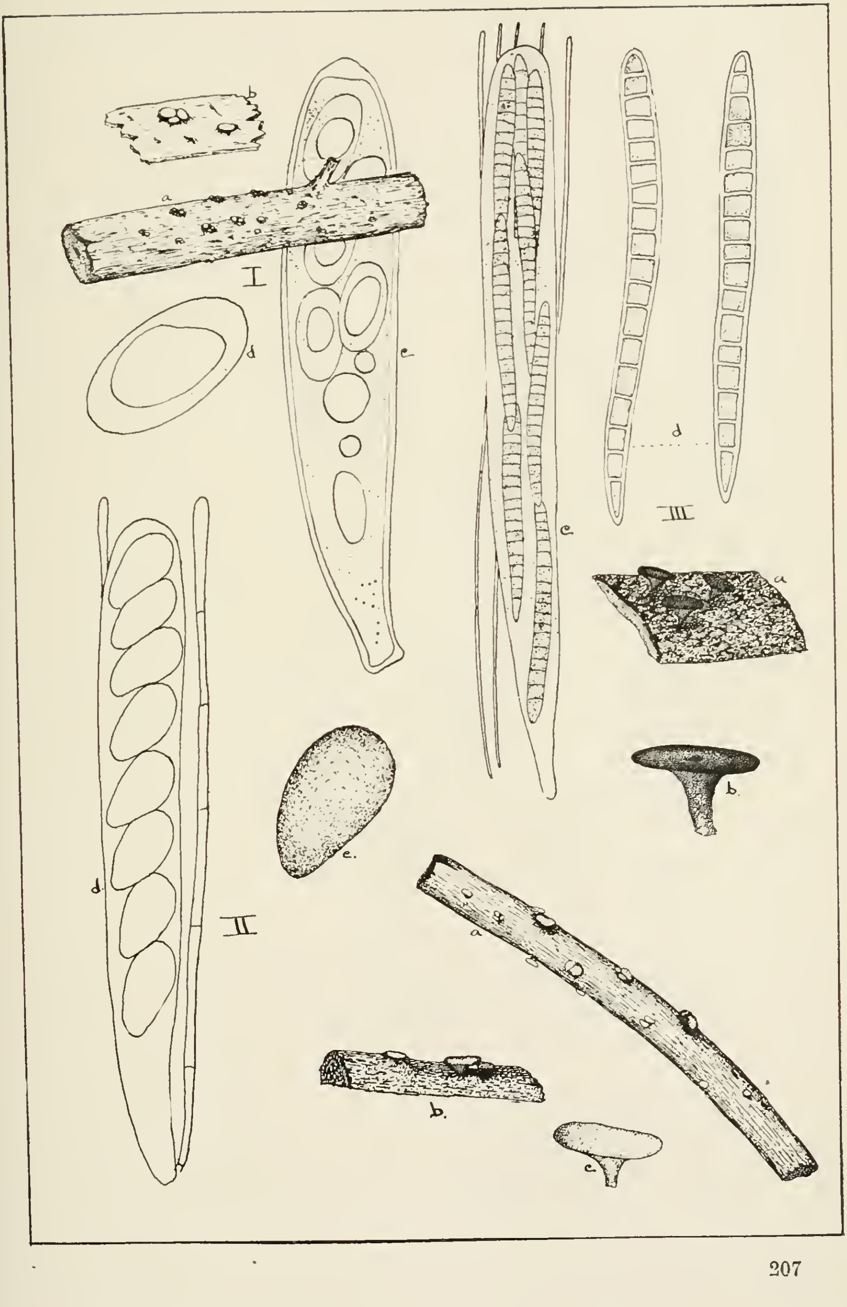
Plate 37


a
I
c
b
c
b
II
a
d

EXPLANATION OF PLATE 38

- I. DERMATEA OLIVASCENS Rehm.
  - a. Clusters of plants natural size.
  - b. Several clusters × 4.
  - c. Ascus with spores × 600.
  - d. One spore × 1200.
- II. CENANGIUM RUBIGINOSUM (Fries) Sacc.
  - a. Clusters of plants natural size.
  - b. Two clusters of plants × 3.
  - c. One plant × 5.
  - d. Ascus with spores × 700.
  - e. One spore × 1500.
- III. HOLWAYA GIGANTEA (Peck) Durand.
  - a. Plants natural size.
  - b. One plant × 5.
  - c. Ascus with spores and paraphyses × 500.
  - d. Two spores × 1000.

PLATE 38



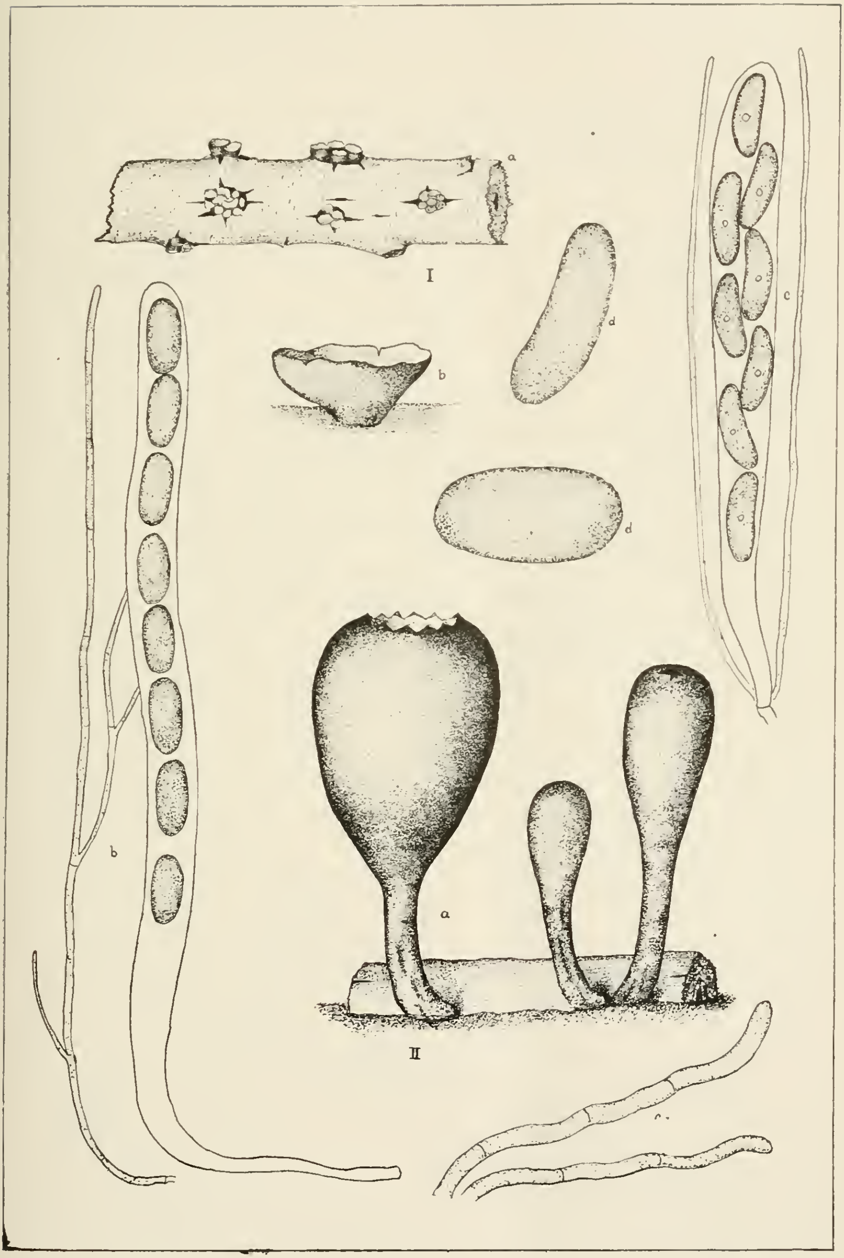
b
a
I
d
e
e
d
III
a
b.
d.
II
e.
a
b.
c.

EXPLANATION OF PLATE 39

I. CENANGIUM POPULNEUM (Pers.) Rehm.
  a. Plants showing habitat natural size.
  b. One plant × 5.
  c. Ascus and paraphyses × 1000.
  d. One spore × 2000.

II. URNULA CRATERIUM (Schw.) Fries.
  a. Three stages in the development of plants, natural size.
  b. Ascus and paraphyses × 500.
  c. Hairs from cup × 1000.
  d. One spore × 1200.

PLATE 39


a
I
b
d
c
d
b
a
II
c

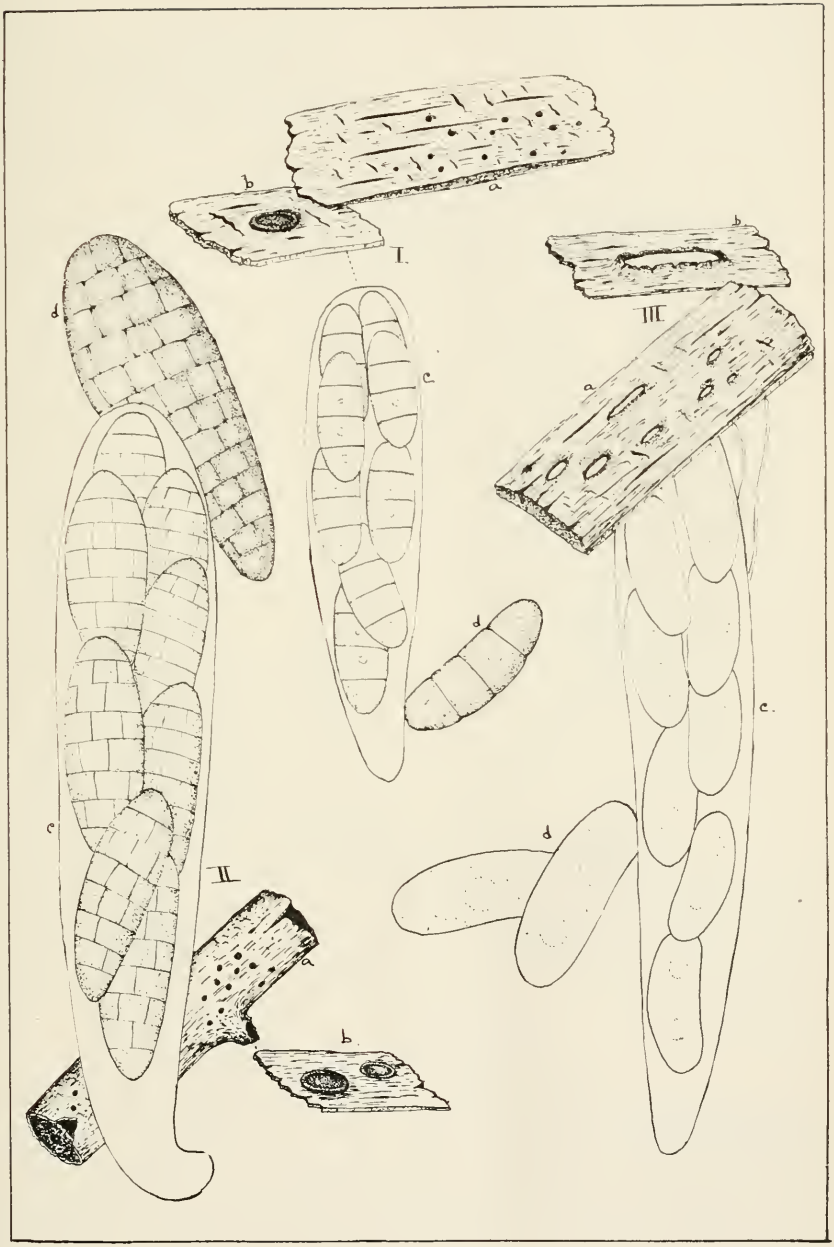
Explanation of Plate 40

I. Mycolecidea triseptata Karst.
- a. Several plants natural size.
- b. One plant × 10.
- d. Ascus with spores × 1000.
- e. One spore × 1200.

II. Blitrydium fenestratum (Cooke & Peck) Sacc.
- a. Several plants natural size.
- b. Two plants × 10.
- c. Ascus with spores × 600.
- d. One spore × 1000.

III. Propolis faginea (Schrad.) Karst.
- a. Several plants natural size.
- b. One plant × 5.
- c. Ascus with spores × 600.
- d. Two spores × 800.

PLATE 40


a
b
I.
c
d
b
III
a
c.
d
c
II
a
b.
d
d

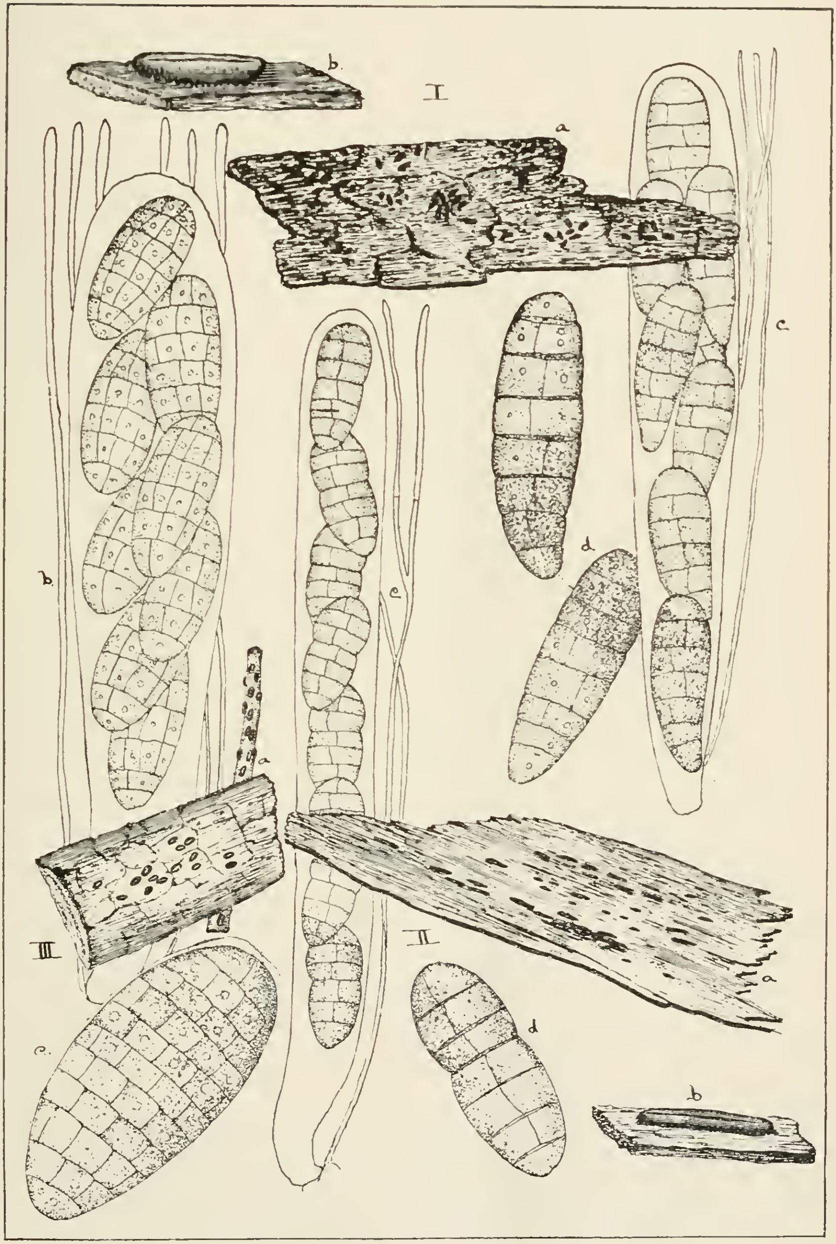
EXPLANATION OF PLATE 41

I. HYSTEROGRAPHIUM KANSENSE Ellis & Everhart.
  a. Plants natural size on bark.
  b. One plant × 10.
  c. Ascus with spores and paraphyses × 800.
  d. Two spores × 1500.

II. HYSTEROGRAPHIUM MORI (Schw.) Rehm.
  a. Plants natural size.
  b. One plant × 10.
  c. Ascus with paraphyses and spores × 700.
  d. One spore × 1500.

III. HYSTEROGRAPHIUM FRAXINI (Pers.) DeNotaris.
  a. Plants natural size.
  b. Ascus with paraphyses and spores × 800.
  c. One spore × 1500.

PLATE 41


b.
I
a
c
b.
c
d
a
III
II
d
a
c.
b

INDEX

Acetabula
acetabulum 74
sulcata 75
vulgaris 74
Aleuria
acetabulum 74
aurantia 77
badia 70
leucoloma 72
omphalodes 55
repanda 69
rutilans, 77
trachycarpa 85
vesiculosa 68
Ascobolus
atro-fuscus 87
brunnea 89
carbonarius 87
carneus 82
ciliatus 83
cinereus 82
crustaceus 85
crec`hqueraultii 61
furfuraceus 88
gigasporus 87
glaber 86
granulatus 72
granuliformis 87
immersus 87
kerverni 90
leveillei 89
macrosporus 87
microsporus 81
miniatus 60
pelletieri 84
pilosus 83
rarapilus 83
sexdecimsporus 85
stercorarius 88
testaceus 82
tetrasporus 71
violaceus 90
viridis 88
Ascophanus
carneus 82
cinereus 82
granulatus 72
granuliformis 81
microsporus 81
sexdecimsporus 85
testaceus 82
Barlaea
amethystina 61
cinnabarina 60
crec'hqueraultii 61
miniata 60
Blitrydium
fenestratum 114
Bulgaria
inquinans 118
ophiobolus 118
rufa 118
sarcoides 105
urnalis 105
CALLORIA
chrysocoma 108
vinosa 108
Cenangium
craterium 119
fasciculare 115
populneum 115
rubiginosum 116
Chlorosplenium
æruginosum 93
chlora 92
schweinitzii 92
versiforme 93
CILIARIA
paludosa 65
Ciboria
pseudotuberosa 95
sulphurella 94

- **Coryne**
  - *purpurea* 105
  - sarcoides 105
  - urnalis 105
- Crouania
  - *cinnabarina* 60
  - *miniata* 60
- **Dasyscypha**
  - nivea 97
  - pygmæa 97
- **Dermatea**
  - cratægicola 117
  - *fascicularis* 115
  - olivascens 116
- Dermea
  - *craterium* 119
- **Detonia**
  - trachycarpa 58
- Discina
  - trachycarpa 58
- Elvela
  - *clavata* 48
  - *coccinea* 91
  - *equina* 83
  - *hemispherica* 64
  - *lubrica* 49
- Encolia
  - *fascicularia* 115
- **Galactinia**
  - succosa 79
- **Geopyxis**
  - *coccinea* 91
  - *craterium* 119
  - nebulosa 73
- **Gloniella**
  - ovata 123
- **Glonium**
  - *microsporium* 123
  - parvulum 122
  - stellatum 122
- **Gorgoniceps**
  - iowensis 103
  - pumilionis 105
- Graphium
  - *giganteum* 119
- **Gyromitra**
  - esculenta 51
- **Helotium**
  - *æruginosum* 93
  - *albo-luteum* 100
  - citrinulum seaveri 103
  - citrinum 102
  - flexuosum 103
  - friesii 102
  - *fructigenum* 101
  - *pygmæum* 97
  - *sulphurellum* 94
  - *testaceum* 82
- **Helvella**
  - *acetabulum* 74
  - *æruginosum* 93
  - crispa 52
  - elastica 52
  - esculenta 51
  - *hybrida* 50
  - lacunosa 52
- **Holwaya**
  - gigantea 118
  - *ophiobolus* 119
- **Humaria**
  - granulata 72
  - leucoloma 72
  - muralis 71
  - *persoonii amethystina* 61
  - *scutellata* 66
  - tetraspora 71
- Hymenoscypha
  - *fructigena* 101
  - *pseudotuberosa* 95
  - *scutula fucata* 101
  - *virgultorum fructigenum* 101
- **Hysterium**
  - *ellipticum* 113
  - *fagineum* 120
  - *fraxini* 124
  - *mori* 125
  - *ovatum* 123
  - *parvulum* 122
  - *prostii* 112
  - pulicare 121

Hysterographium
    cinerascens 125
    fraxini 124
    kansense 124
    mori 125
    pulicare 121
Hysteropatella
    clavispora 113
    elliptica 113
    prostii 112
Karschia
    lignyota 111
    tavelina 111
Lachnea
    abundans 65
    albo-spadicea 64
    aurantiopsis 67
    coccinea 91
    fusicarpa 76
    hemispherica 64
    lojkæana 63
    melaloma 68
    paludosa 65
    pygmæa 98
    scutellata 66
    setosa 67
    stercorea 67
Lachnella
    nivea 97
    pygmæa 98
Lachnum
    sulphureum 99
Lamprospora
    miniata 60
Lasiobolus
    equinus 83
    raripilus 83
Lecanidion
    stratum 110
    tetraspora 110
Leciographa
    clavispora 113
    triseptata 111
Leotia
    lubrica 49
    stipitata 48
Leucoloma
    hedwigii 72
    tetraspora 71
Lichen
    atratus 110
    sarcoides 105
Macropodia
    fusicarpa 76
    macropus 75
Mollisia
    atrata 107
    cinerea 107
    dehnii 106
    polygoni 107
Monilia
    seaveri 95
Morchella
    conica 50
    crassipes 51
    deliciosa 50
    esculenta 50
    hybrida 50
Mycolecidea
    triseptata 111
Neottiela
    luteo-pallens 63
Niptera
    cinerea 107
Octospora
    citrina 102
    fasciculata 64
    leucoloma 72
    nivea 97
Ombrophila
    purpurea 105
    sarcoides 105
Orbilia
    chrysocoma 108
    vinosa 108
Otidea
    leporina 79
    onotica ochracea 80
Patellaria
    atrata 110
    clavispora 113
    fenestrata 114

- **Patellaria**—Continued
  - melaxantha 104
  - tetraspora 110
  - *triseptata* 111
- **Peziza**
  - *abundans* 65
  - *acetabulum* 74
  - *æruginosa* 93
  - *albo-lutea* 100
  - *albo-spadicea* 64
  - *arenicola* 62
  - *atrata* 107
  - *aurantia* 77
  - *aurantiopsis* 67
  - *auriflava* 61
  - badia 70
  - brunneo-atra 70
  - *chlora* 92
  - *chrysocoma* 108
  - *ciliata* 66
  - *cinerea* 107
  - *coccinea* 91
  - *comata* 99
  - *confusa* 58
  - *craterium* 119
  - *crocitincta* 92
  - *crouani* 60
  - *dehnii* 106
  - *fascicularis* 115
  - *flavo-fuliginea* 100
  - *floccosa* 91
  - *fructigena* 101
  - *fuscocarpa* 73
  - *fusicarpa* 76
  - *friesii* 102
  - *granulata* 72
  - *inquinans* 118
  - *lætirubra* 60
  - *leporina* 79
  - *luctuosa* 107
  - *luteo-pallens* 63
  - *macropus* 75
  - *melaloma* 56
  - *morgani* 76
  - *muralis* 71
  - *nebulosa* 73
  - *nigra* 118
  - *nivea* 97
  - *occidentalis* 91
  - *omphalodes* 55
  - *onotica ochracea* 80
  - *papillata* 83
  - *patellaria* 110
  - *polygoni* 107
  - *polymorpha* 118
  - *populnea* 115
  - *pubida* 76
  - *pygmæa* 97
  - repanda 69
  - *rubiginosa* 116
  - *rutilans* 77
  - *sarcoïdes* 105
  - *scutellata* 66
  - *setosa* 67
  - *stercoraria* 88
  - *stercorea* 67
  - *succosa* 79
  - *sulcata* 75
  - *sulphurea* 99
  - *testacea* 82
  - *tetraspora* 71
  - *tiliæ* 98
  - *trachycarpa* 58
  - *variecolor* 100
  - *velutina* 76
  - *versiforme* 93
  - vesiculosa 68
  - *vinosa* 108
- **Phaeopezia**
  - fuscocarpa 73
- Phallus
  - *crispus* 52
  - *esculentus* 50
  - fructigena 101
- **Phialea**
  - fructigena 101
  - scutella fucata 101
- Plicariella
  - *trachycarpa* 58
- **Propolis**
  - faginea 120

Pustularia
  vesiculosa 69
Pyrenopeziza
  atrata 107
Pyronema
  confluens 55
  melaloma 56
  omphalodes 55
Ryparobius
  crustaceus 85
  pachyascus 85
  sexdecimsporus 85
Saccobolus
  kerverni 90
  violaceus 90
Sarcoidea
  sarcoides urnalis 105
Sarcosphypha
  coccinea 91
  floccosa 91
  occidentalis 91
Sarcosoma
  rufa 118
Sarcosphaera
  arenicola 62
Sclerotinia
  pseudotuberosa 95
  seaveri 95
  tiliæ 95
Sepultaria
  albida 64
Spathularia
  clavata 48
  flavida 48
Sphaerosoma
  echinulatum 53
Sphaerospora
  confusa 58
  scutelloides 57
Stilbum
  giganteum 118
Stromatinia
  pseudotuberosa 95
Stictis
  versicolor 120
Thecotheus
  pelletieri 84
Tremella
  stipitata 48
Triblidium
  clavisporum 113
Trichopeziza
  albo-lutea 100
  comata 99
  sulphurea 99
  tiliæ 98
Tympanis
  conspersa 117
Urnula
  craterium 119

CONTRIBUTIONS FROM THE NEW YORK BOTANICAL
GARDEN—No. 134

STUDIES ON THE ROCKY MOUNTAIN FLORA—XXII

By PER AXEL RYDBERG

NEW YORK
1910

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL
CLUB 37: 313-335. 21 Jl 1910

[From the Bulletin of the Torrey Botanical Club, 37: 313-335. 1910.]

Studies on the Rocky Mountain flora — XXII

Per Axel Rydberg

Erigeron

Just as the writer resumed his work on *Erigeron*, Coulter and Nelson's New Manual of Botany of the Central Rocky Mountains came out. From all evidences it is apparent that most of the work in connection with the new book has been done by Professor Aven Nelson, of the University of Wyoming. The work is a great improvement on the old Coulter's Manual and it is perhaps the best manual that has been put out treating on the botany of the West. It has, however, many features to which the present writer is unwilling to subscribe. Dr. B. L. Robinson in his recent review* has pointed out the unevenness in the nomenclature, in that the Vienna Code has been followed in some cases, in other cases not. But this is easy for me to understand, for Professor Nelson has until lately followed the "Rochester Code," and it is not so easy to change the nomenclature of one's thinking and writing and make it self-consistent.

A few years ago, when Professor Nelson published his "New Plants from Wyoming" in the Bulletin of the Torrey Botanical Club, he was about as "radical" as the present writer, and had about the same limitation of species. If we should judge from the New Manual, his conception of a species seems to have changed considerably, as seen from the number of specific names reduced to synonymy. Whether this change of attitude has slowly grown upon Professor Nelson or is due to influence from his collaborators, I can not tell. There is, however, one feature in this connection that seems to me somewhat unexplainable. Professor Cockerell in his review† of the book stated:

"I have had the curiosity to count the number of species admitted as valid in the new manual, which were undescribed at the time of the publication of the first edition in 1885. They

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*Rhodora **12**: 13–16. Ja 1910.

†Science II. **31**: 302. 1910.

number 787, about 28 per cent. of the whole flora . . . Of the 787, no less than 244 were proposed by Professor Aven Nelson himself; 152 are by Dr. Rydberg, of the New York Botanical Garden, and 148 by Dr. E. L. Greene, now of the U. S. National Museum, but at one time a resident of Colorado. . . . The number of species accepted as valid is 2,733, while no less than 1,788 specific names are rejected as synonyms or insufficiently known. Many of those latter were proposed by Professor Nelson himself, more by Rydberg and Greene."

Why should more (nearly 66 per cent. more) of Professor Nelson's species be acceptable and "many more" of Dr. Greene's and my own be reduced to synonymy? Not counting the time before the first edition of the Manual of the Rocky Mountain Region appeared, Dr. Greene published on the flora for ten years, between 1885 and 1895, when practically no work was done by Professor Nelson or myself, and he has published at least twice as many new species from the Rocky Mountain Region as Professor Nelson. Both Dr. Greene and myself have had access to much larger herbaria and libraries than has Professor Nelson, and have seen specimens from the Rockies which he has not seen. The New Manual, therefore, seems to show a decided partiality for the species proposed by Professor Nelson himself. Some partiality would be expected, but in this case it seems out of proportion. Professor Nelson is a very conscientious worker, and it would be unjust to claim that this imparity in treatment was intentional. The main cause, I think, is that he had not seen the types or authentic material of many of the species so reduced. He knew his own species, but not all of those proposed by other botanists. It was not fair to them simply to reduce their species to synonymy, if such species were unknown. If question-marks had been added to show probable synonymy, the matter would have been improved considerably. There are many cases in which I am confident that Professor Nelson had no specimens illustrating species reduced to synonymy.

Some years ago I spent considerable time on *Erigeron* as repre-ented in the Rockies and had seen the type or a duplicate of the type of nearly every species described. In fact, I knew the genus (one of the largest in the region) as well as any of the composite genera. That I should have resumed the work on that genus just as I received the New Manual was a curious coincidence. There is scarcely a genus, in which I, from my standpoint, could pick out so many flaws of treatment in the New Manual. This paper, therefore, has become an adverse criticism of the New Manual, more so than I had intended or wished.

The way in which the authors of the New Manual have determined what species should be regarded as good and which names should be reduced to synonymy, is rather interesting. Many of Dr. Greene's species and my own have been reduced, while others of older authors and of Nelson's have been kept up. The uneven treatment, as I have said before, is due in some cases to the fact that the authors had not seen the types. *Erigeron lapiluteus* A. Nels. (*E. yellowstonensis* A. Nels.) is regarded as distinct from the exceedingly close *E. droebachensis*, and *E. trifidus* from *E. compositus;* while *E. jucundus* Greene is made a variety of the little related *E. acris* L., *E. multifidus* Rydb. is made a synonym of *E. compositus*, and *E. flabellifolius* Rydb. one of *E. trifidus*. The fact is that *Erigeron multifidus* Rydb. is much closer to *E. trifidus* than to *E. compositus* and grades directly into it. The typical *E. compositus* is rare and more distinct. I think, though, that they are all three forms of one species, while *E. flabellifolius* has nothing to do with either. It has a stoloniferous rootstock instead of a cespitose caudex and the leaves do not at all suggest *E. trifidus* but are more like those of *Ranunculus Eschscholtzii* in outline.

Erigeron conspicuus Rydb. is made a synonym of *E. speciosus* DC. In the herbarium of Columbia University there is a duplicate of the type of *E. speciosus* DC., collected by Douglas. In this the stem and leaves are perfectly glabrous except the ciliate margins of the latter and the plant is closely related to *E. macranthus* Nutt., perhaps not distinct. *E. conspicuus* Rydb. is considerably hairy on both the stem and the leaves, and if reduced should be included in *E. subtrinervis* Rydb. rather than in *E. speciosus*. If the type of *E. conspicuus* were placed before a student and he used the key of the New Manual, it would be named *E. subtrinervis*.

Both *Erigeron salicinus* Rydb. and *E. platyphyllus* Greene are made synonyms of *E. macranthus* Nutt. While the first is closely related to that species, the second can scarcely be said to be so. Its habit, foliage, and pubescence are those of *E. subtrinervis* and only the involucral bracts are those of *E. macranthus*.

Erigeron incanescens Rydb., *E. eximius* Greene, and *E. viscidus* Rydb. are all made synonyms of *E. formosissimus* Greene. The first has a hirsute involucre and is related to *E. subtrinervis;* the third and fourth have glandular-puberulent involucre and may well be united. The authors have included *Erigeron formosissimus* also among the annuals or biennials, though it is evidently a perennial. The third has also glandular involucres, but is almost glabrous and should have been included in *E. asper* of the New Manual if reduced.

Erigeron glabellus Nutt., *E. consobrinus* Greene, *E. oblanceolatus* Rydb., and *E. Earlei* Rydb. are made synonyms of *E. asper* Nutt. *E. glabellus* and *E. Earlei* have perennial branched rootstock; the rest are biennial with tap-roots. They may perhaps sometimes be perennial, but there is no evidence of a branched rootstock. In *E. glabellus* the pubescence is spreading, in *E. Earlei* closely appressed.

Erigeron nematophyllus Rybd. is made a synonym of *E. Eatonii* A. Gray. The latter is not uncommon in Utah, where I have collected it myself. A duplicate of the type is in the Columbia University herbarium. It has narrowly linear-oblanceolate, distinctly triple-nerved basal leaves and decidedly flattened achenes. In *E. nematophyllus* the leaves are almost filiform and strictly one-nerved. Evidently Professor Nelson did not know *E. Eatonii*, for what he has distributed under that name is *E. nematophyllus*. The only specimens of the real *E. Eatonii* from Wyoming in our collections are from Wind River Mountains, and there collected by Merrill & Wilcox and by Tweedy.

Erigeron curvifolius Piper is made a synonym of *E. luteus* A. Nels., although they are not closely related, the former being a coarsely hirsute plant, with leafy stem, the latter being a closely strigose subacaulescent plant. It would have been much better to reduce Nelson's own *E. luteus* to a synonym of *E. peucephyllus* A. Gray, to which it is closely related.

Erigeron Parryi Canby & Rose, *E. Scribneri* Canby, and *E.*

vetensis Rydb., are made synonyms of *E. radicatus*. *E. vetensis* has an involucre of two series of subequal bracts, a simple pappus, consisting of bristles only, of which some are occasionally shorter. Both *E. Parryi* and *E. Scribneri* have 3 or 4 series of bracts, more imbricated and more flat, obovate-cuneate achenes and double pappus, the outer squamellate. Both are closely related to *E. montanensis*, which Nelson refers to *Wyomingia*.

ERIGERON YELLOWSTONENSIS A. Nels. Bot. Gaz. **31**: 198. 1900

Erigeron lapiluteus A. Nels.; Coult. & Nels. New Man. Cent. Rocky Mts. 530. 1909.

Professor Nelson states in the New Manual that *Erigeron yellowstonensis* is a name to be rejected, but he does not state on what ground, probably because it is of barbaric origin, regarded from a Latin standpoint. But what should be said about *E. lapiluteus* which is to replace it? Is it Latin? It is probably meant to be derived from *lapis*, stone, and *luteus*, yellow. In making a compound word the Romans usually took the stem of the first word and connected it with the second word by means of the connecting vowel *i*. The stem of *lapis* is *lapid*, as seen from the genitive *lapidis*. The proper form would then have been *lapidiluteus*. But what would that have meant? Usually the Romans placed the modifying word first (not always though), as is done in the English, and the name *Erigeron lapidiluteus* would mean the "stone-yellow fleabane." The intention was evidently to name it the "fleabane of the yellow stone." The only proper way to express this would be by the specific name *lapidis lutei* or, as it has become the custom in botany to capitalize proper names, and use a hyphen when the specific name consists of more than one word, *Lapidis-lutei* or *Lutei-lapidis*, as the order of the adjective is indifferent.

Professor Nelson states also that "the variety *droebachensis* [of *E. acris*] probably does not occur in our range." *Erigeron droebachensis* Muell., is as common in the Rockies as is *E. yellowstonensis*. The question is whether they should be kept apart specifically. The only difference I can find is that the latter is more hairy with shorter hairs, decidedly glandular-puberulent in the inflorescence, and the involucre is more decidedly hirsute. In the herbarium of the New York Botanical Garden there are several Scandinavian specimens of *E. droebachensis* Mueller (*E. Muelleri* Lund.), one from the vicinity of Christiania; the town of Droebach is only a short distance south of Christiania. These specimens are perfectly matched by specimens from Quebec, Subarctic America, Yukon, Canadian Rockies, and Colorado. *Erigeron acris* L., which is included in the New Manual, is on the contrary not found in America. It differs from all the North American species of the group, except the very rare *E. alpinus*, in having villous rather than hirsute or puberulent involucres.

ERIGERON COMMIXTUS Greene, Pittonia **5**: 58. 1902

E. cinereus A. Gray, Mem. Am. Acad. **4**: 68. 1849. Not *E. cinereus* H. & A. 1836.

E. colo-mexicanus A. Nels.; Coult. & Nels. New Man. Cent. Rocky Mts. 529. 1909.

Another specific name proposed by Professor Nelson, *Erigeron colo-mexicanus*, to replace the untenable *E. cinereus* A. Gray, is in my opinion rather distasteful. Fortunately I do not need to use the name, as the same species has been described by Dr. Greene under the name *E. commixtus*.

ERIGERON UNIFLORUS L. Sp. Pl. 864. 1753

The typical form of this species is, so far as I know, not found on this continent. As Dr. Greene has pointed out, the European species is characterized by narrow erect or ascending rays. This character is found also in *Erigeron pulchellus unalaschkensis* DC. Prod. **5**: 287 (*E. uniflorus pulchellus* Fries), which is not uncommon in America from Greenland to Labrador, Montana, and Alaska. In the latter the involucre is more or less turbinate, tapering into the enlarged end of the stem, and black-hairy, while in the typical *E. uniflorus* the involucres are hemispheric, and more or less white-hairy, and the stem is not thickened. Whether the two are specifically distinct or not is hard to tell. In Greenland both forms are found. If the variety is to be regarded as a species, **Erigeron unalaschkensis** (DC.) is the only available name, as *E. pulchellus* has been used by Michaux for another species.

The plant referred to *Erigeron uniflorus* in the Flora of Colorado is distinct and easily distinguished by its broad spreading rays. The name it should bear is *E. simplex* Greene. *E. leucotrichus* Rydb. is a more luxuriant form of the same. It is questionable if *E. melanocephalus* Nelson should not be included in it also, differing only in the blackish hairiness of the involucre.

Professor Piper in his flora of Washington has transferred the name *Erigeron filifolius* (Hook.) Nutt. to what was usually known under the name *E. peucephyllus* A. Gray. This change was wholly unwarranted, I think. There are duplicates of the types of both *Diplopappus filifolius* Hook. and *Erigeron filifolius* Nutt. in the Columbia University herbarium, and they both belong to the species described under the latter name in Gray's Synoptical Flora. What probably led Professor Piper astray was the following words in Hooker's description: "*radiis flavescentibus*." This does not necessarily mean that the plant has yellow rays. The original meaning of *flavescens* is turning (light) yellow. White flowers often turn yellowish in drying. As *E. filifolius* has white as well as violet rays, the rays are often yellowish in drying.

WYOMINGIA

As instituted in the New Manual this genus is very unsatisfactory, for if the more imbricated bracts with thickened backs are made the distinguishing character separating *Wyomingia* from *Erigeron*, then *E. Garrettii* A. Nels., *E. tener* A. Gray, *E. Tweedyi* Canby, *E. caespitosus* Nutt., *E. nevadensis* A. Gray, *E. luteus* A. Nels., *E. filifolius* Nutt., etc., should be included in *Wyomingia*. If the achenes should count for anything, *E. montanensis* and perhaps *E. canus* could not very well be included. The former has flattened achenes and the latter has glabrous and 8–10–nerved achenes, while the rest of the genus has pubescent and 4–5–angled achenes. It would be desirable to take out *Wyomingia* as a genus, for the plants fit rather poorly in *Erigeron*, but the question is where to draw the line. The species with flattened achenes with the involucre of *Wyomingia* would constitute a rather natural genus, but such species as *E. utahensis* destroy the distinctness.

ANTENNARIA

A footnote under this genus in the New Manual states: "The treatment of this genus is largely an adaptation of Professor Elias

Nelson's clear and discriminating revision of a large part of the genus." While Elias Nelson's treatment is in the main excellent, the writer is inclined to take some exceptions to this as well as to that of the New Manual. In the latter we find the following key of the *A. alpina* group:

- Stems very slender, 2–7 cm. high. 1. *A. media.*
- Stems medium, 8–15 cm. high.
    - Leaves broadly spatulate; involucres 6–7 mm. high. 2. *A. fusca.*
    - Leaves spatulate-oblanceolate; involucres about 5 mm. high.
        - Leaves obtuse, tomentose. 3. *A. reflexa.*
        - Leaves acute, canescent. 4. *A. umbrinella.*

The only species that can be separated out by this key is *Antennaria fusca.* The key is not workable otherwise. *A. media* is often 8–10 cm. high and *A. umbrinella* and *A. reflexa* are often less than 7 cm. high. In both *A. reflexa* and *A. umbrinella* as limited in the New Manual and in E. Nelson's paper are the leaves both tomentose and canescent, as the one word indicates the kind of pubescence, and the other word the color of the same. E. Nelson merges *A. mucronata* E. Nels. in *A. umbrinella* Rydb. and *A. flavescens* Rydb. in *A. reflexa* E. Nels. Under the latter he makes the following statement: "In describing *A. umbrinella* Dr. Rydberg confused two species . . . The male and female plants of his type are of different species. One of these he later named *A. flavescens*, and the staminate plants of this and his *A. umbrinella* are identical." It is true that there were a few staminate specimens of *Antennaria flavescens* mixed in the type collection of *A. umbrinella*, but there were also a few staminate specimens of the latter. I saw the plant in field, as I was present when Professor J. Flodman collected the type, but we did not then notice that another species was growing with it. The staminate plants of *A. umbrinella*, *A. flavescens*, and *A. reflexa* are very much alike and hard to separate. *A. flavescens* has somewhat narrower bracts and the leaves are usually more or less yellowish and with a very fine and closely appressed silky tomentum. The difference between the staminate plants of *A. umbrinella* and *A. reflexa* I can not describe. The staminate plant of *A. mucronata* is very different, more resembling that of *A. media*, but the inner bracts are nearly white, the outer very dark brown. E. Nelson states that typical staminate plants are unknown. The only ones I have seen and which I think belong here are *Goodding 430*, from Ten Sleep Lakes, Big Horn County, Wyoming, and labeled *A. nardina*.

The pistillate plants of the four species are easier to distinguish. *Antennaria mucronata* has very dark greenish brown bracts, as dark as those of *A. media* but the inner bracts are oval, obtuse or even rounded at the apex, and inclined to be white-tipped. The leaves of the rosettes are narrower and with more appressed pubescence. The bracts of the pistillate head of *A. umbrinella* have about the same shape as those of *A. mucronata* but are from light umber-brown to almost yellowish, and of the same color throughout. The leaves are much shorter and broader, like those of *A. media*, but with appressed tomentum. The bracts of the pistillate heads of *A. flavescens* are still lighter than those of *A. umbrinella*, being yellowish or brownish white, oblong and scarcely more than half as broad, but still obtuse. The leaves are yellowish. It would have been better to have designated *Rydberg & Bessey 5146* instead of *5145* as the type, because the former number contains pistillate as well as staminate plants. The pistillate heads of *A. reflexa* have bracts of a color similar to that of *A. umbrinella* but they are decidedly acute and resemble those of *A. media* in shape.

The staminate plants of this group are very rare, except in *Antennaria flavescens*, in which it is the common form, the pistillate plant being comparatively rare. In the herbarium of the New York Botanical Garden the staminate plants are represented by the following specimens:

Antennaria alpina (L.) Gaertner: *J. Källström* (Tronfjeld, Norway).

A. monocephala DC.: *Wm. Horne* (Karluk, Alaska), *Blaisdell* (Cape Nome, Alaska).

A. media Greene: *Hall & Chandler 686* (Mt. Goddard, Calif.); *Sonne 160* in 1888 (Bear Creek, Placer Co., Calif.) and in 1892 (Coldstream, Calif.).

A. mucronata, E. Nels.: *L. Goodding 430* (Ten Sleep Lakes, Wyo.).

A. umbrinella Rydb.: *Flodman 859* (partly) (Long Baldy, Mont.); *Macoun 69339* (Meyer's Creek, B. C.); *Umbach 615* (Midvale, Mont.); *Rydberg & Bessey 5164* (Mt. Chauvet, Idaho); *Shear & Bessey 3971* (Steamboat Springs, Colo.).

A. flavescens Rydb.: many specimens.

A. reflexa E. Nels.: *Goodding 114* (Pedro Mountains, Wyo.); *Goodding 380* (Doyle Creek, Wyo.); *A. Nelson 853* (Union Pass, Wyo.).

A. pulvinata Greene: *Richardson* (?), from Hooker's herbarium.

Antennaria rosea (D. C. Eat.) Greene has a peculiar history. The citation of Eaton should perhaps be omitted, for Eaton[*] gave no description. The first description was given by myself under the name *A. parvifolia*,[†] on the supposition that it was the same as *A. parvifolia* Nutt.[‡] It might have been included partly in the description of that species, but Professor Piper has shown that Nuttall's type belongs rather to *A. aprica* Greene. It was afterwards described by Greene as *A. rosea*,[§] the author giving *A. dioica rosea* Eaton as a synonym. As that was a *nomen nudum*, it should be "ignored" as Greene[||] stated later, and *A. rosea* is based wholly upon Greene's description. The type of *A. rosea* would then be *Sheldon 128*, which is first cited, rather than *Watson 652*, which is not cited at all. *Sheldon 128* is the monotype of Greene's *A. sordida*.[¶] The proposer of the latter must have forgotten or ignored what he had done a year earlier. E. Nelson gives *A. sordida* as a synonym of his *A. rosea angustifolia*, based on my *A. angustifolia*.[**] There is no use of keeping up a variety if the type of the species belongs to the variety! Besides, *Sheldon 128* and *Watson 652* are almost identical. *A. angustifolia* Rydberg is somewhat similar, but has narrower involucral bracts, of which the inner are very acute. It is not found in the Rocky Mountain region.

In the New Manual, *A. anaphaloides* Rydb. is made a synonym of *A. pulcherrima*. Piper, who is fully as "conservative" as A. Nelson, keeps them distinct, however. So did also E. Nelson. The description of *Antennaria pulcherrima* in the New Manual is an almost verbatim copy of my description of *A. anaphaloides*. The description, especially that of the pistillate head, does not at all agree with a duplicate of the type of *A. pulcherrima* in the Torrey herbarium. In the latter, the bracts are imbricated in 6 or 7 series, wholly brown, the innermost very narrow and acuminate. *A. foliacea* Greene is wholly ignored, although E. Nelson had it in his paper. *A. Sierrae-Blancae* Rydb. is made a synonym of *A. rosulata*, although the words "leaves glabrate above" are added after the reference. Probably the authors had not seen any specimens. The characters of the bracts (not referred to) are a better distinction than the mere lack of tomentum. On the other hand, *Antennaria oblanceolata* Rydb. is kept distinct from the closely related *A. luzuloides*. In the key the latter is placed under the heading "bracts tomentose except the scarious tips"; but in the description is stated "involucres glabrous nearly or quite to the base." The latter characterization is correct and *A. luzuloides* should be associated with *A. oblanceolata* instead of *A. pulcherrima* in the key.

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[*] Bot. King Exp. 186. 1871.

[†] Bull Torrey Club **24**: 301. 1897.

[‡] Trans. Am. Phil. Soc. II. **7**: 406.

[§] Pittonia **3**: 281. 1898.

[||] Pittonia **4**: 81. 1899.

[¶] Pittonia **4**: 81. 1899.

[**] Bull. Torrey Club **26**: 546. 1899.

Antennaria acuta sp. nov.

A surculose-stoloniferous perennial; stems slender, 5–12 cm. high; stolons short and mostly ascending; basal leaves and those of the stolons narrowly oblanceolate, greenish-white, tomentose on both sides, glabrate in age, 15–25 mm. long, 2–4 mm. wide, acute or abruptly short-acuminate; tomentum very fine and appressed; stem-leaves narrowly linear or linear-oblanceolate; heads 3–5, conglomerate, sessile; involucres about 6 mm. high, tomentose below; bracts of the pistillate heads lanceolate to linear-lanceolate, dark greenish brown with slightly lighter tips, the inner acute.

This is related to *Antennaria alpina* and *A. media*. It resembles perhaps most the former but the leaves are equally tomentose on both sides. From *A. media* it differs in the narrower, acute or acuminate leaves with a finer, closely appressed tomentum.

ALBERTA: Marsh near Lake O'Hara, Aug. 8, 1904, *J. Macoun 65423* (type in herb. N. Y. Bot. Gard., duplicate in herb. Geol. Surv. Canada); also Bow River at Laggan, July 25, 1904, *65413;* and Pipestone Creek, July 6, 1904, *65422.*

GNAPHALIUM

In Coulter & Nelson's New Manual both *Gnaphalium sulphurescens* Rydb. and *G. thermale* E. Nels. are cited as synonyms of

G. Wrightii. *G. thermale* is closely related to that species and may be regarded as a form thereof by a conservative systematist, but the first one named is not.

At the end of the description of *Gnaphalium Wrightii* the following note is given: "*G. thermale* E. Nels. Bot. Gaz. **30**: 121. 1900, the description of which is here used." If *G. thermale* is to be included in *G. Wrightii*, it is at least not the normal condition of that species and the description of the small *G. thermale* gives a poor idea of *G. Wrightii*, which is a tall plant, 3–5 dm. high. To use the description of one species for another is as a rule very unsafe, unless the identity is established without any doubt.

Gnaphalium albescens Osterh., *G. proximus* Greene, and *G. lagopodioides* Rydb. are not accounted for at all in the New Manual, although they were described from material collected in the region covered by the work. The first, I think, is a pure synonym of *G. Wrightii;* the other two, as well as *G. sulphurescens*, are closely related to *G. chilense* Sprengel (*G. Sprengelii* H. & A.). All three have the obtuse bracts and subdecurrent leaves of that species. *G. proximus* was based on *Aven & Elias Nelson 6036* and is closest to *G. chilense.* The specimens were distributed as *G. Sprengelii* and are evidently included in *G. chilense* in the New Manual. If *G. sulphurescens* should be reduced to synonymy it should be under *G. chilense* not under *G. Wrightii.*

Gnaphalium uliginosum L. is also omitted, although it has been collected in both Colorado and Utah.

Gnaphalium angustifolium A. Nels. is antedated by both *G. angustifolium* Lam. and *G. angustifolium* Loisel.; but as those species now are referred to *Helichrysum* it may be that *G. angustifolium* is tenable according to the Vienna Rules. A poor rule indeed, when the validity of the name *G. angustifolium* A. Nels. depends upon whether two species of the Old World are kept in *Gnaphalium* or not. Three years after *G. angustifolium* A. Nels. was published, the proposer of that species substituted the name *G. exilifolium*, which name is wholly ignored in the New Manual.

Gnaphalium Williamsii sp. nov.

Probably biennial; stem 3–6 dm. high, branched above, loosely floccose; leaves linear or linear-lanceolate, decurrent, 5–10 cm. long, almost equally floccose on both sides with loose, not dense tomentum, sometimes slightly glandular; inflorescence large, corymbosely paniculate; heads somewhat conglomerate at the ends of the branchlets; involucre hemispheric or nearly so, 6 mm. high, only slightly tomentose at the base; bracts broadly ovate, acute, light straw-colored or white; achenes glabrous; pappus straw-colored.

This species is intermediate between *Gnaphalium microcephalum* and *G. decurrens*; perhaps more closely related to the latter, of which it has the general habit and the larger nearly hemispherical involucres, but the leaves are nearly as tomentose above as beneath. They are slightly if at all glandular; the stem is not at all so. The pubescence is that of *G. microcephalum* but the inflorescence is more open and inclined to be flat-topped and both the involucre and its bracts are much broader.

MONTANA: Columbia Falls, Aug. 11, 1894, *R. S. Williams* (type, in herb. N. Y. Bot. Gard.); woods, Belton, Aug. 25, 1903, *Umbach* 752.

NACREA A. Nels.

I believe that this genus is based on the essentially staminate plant of *Anaphalis*. There is a duplicate of the type of *Nacrea lanata* in the herbarium of the New York Botanical Garden, but the specimens are so young that the real structure of the flowers can not be made out. It may be that Nelson had better developed material on hand. The expressions "akenes (immature in these specimens)" indicate, however, that he did not have developed fruit. The so-called staminate flowers of *Anaphalis* are in reality hermaphrodite flowers with sterile pistils. (See Bentham & Hooker, Genera Plantarum.) The styles in them are undivided and the achenes remain undeveloped. In the description of *Nacrea* there is nothing said about the styles being undivided or 2-cleft. In the herbarium of the New York Botanical Garden there are two specimens collected in the Big Horn Mountains, one by T. A. Williams in 1898, and the other by Dr. H. Hapeman in 1892, which (especially the first mentioned) are so close in every respect to the duplicate of the type of *Nacrea lanata*, that anybody would take them for the same species. They are better developed and belong without doubt to an *Anaphalis*. Whether they can be separated specifically from *A. subalpina* is doubtful.

Anaphalis angustifolia sp. nov.

Perennial with a creeping rootstock; stems slender, strict, simple, white-tomentose, 3–6 dm. high; leaves narrowly linear, 1-nerved, 5–10 cm. long, 2–5 mm. wide, ascending, densely white-tomentose beneath, less so above, greener and often glabrate in age; inflorescence small, corymbiform, 2–3 cm. high, 3–4 cm. wide; heads hemispheric; involucres about 5 mm. high; bracts pearly white, elliptic, obtuse or acutish.

This species is more related to the eastern *Anaphalis margaritacea* than to *A. subalpina*, having narrow and 1-ribbed leaves, but differs in the smaller inflorescence, smaller heads, narrower bracts, and narrower and ascending instead of spreading leaves.

MONTANA: Mount MacDonald, July, 1900, *Elrod & assistants* (type, in herb. N. Y. Bot. Gard.); Big Fork, Aug. 9, 1901, *Umbach 15*.

BALSAMORRHIZA

Professor Nelson has reduced *Balsamorrhiza hirsuta* Nutt. and *B. terebinthacea* Nutt. to varieties of *B. Hookeri* and *B. macrophylla* respectively. Although the first has a superficial resemblance in the cutting of the leaves to *B. Hookeri*, it is much more closely related to *B. macrophylla* in every respect, differing only in the smaller heads and more dissected leaves. In his key Professor Nelson gives the following characters:

Leaves entire or somewhat toothed.	1. *B. sagittata.*
Leaves not entire, laciniately dentate to bipinnatifid.	
Green, glabrous or sparingly hisute.	2. *B. macrophylla.*
Canescent or lanate.	
The sericeous pubescence appressed or spreading.	3. *B. Hookeri.*
The white tomentum often floccose.	4. *B. incana.*

How would it be possible to locate *B. Hookeri hirsuta* by means of this key? As its leaves are pinnatifid, green, and hirsute, it would key into *B. macrophylla* instead of *B. Hookeri*. On the following page Professor Nelson gives only the following: "The pubescence roughish hirsute and spreading, not canescent or tomentose," as distinguishing the var. *hirsuta* from *B. Hookeri*, just the same characters which he in the key has used as separating *B. macrophylla* from *B. Hookeri*. The latter is not found within the range.

Balsamorrhiza terebinthacea Nutt. is not closely related to *G.*

macrophylla. In the latter the outer involucral bracts are elongated and reflexed; the former has the involucre of *B. Careyana* with appressed bracts. I doubt that *B. terebinthacea* is found east of northwestern Idaho.

It is a kind of puzzle to me, to determine what rule Professor Nelson followed in making these reductions. The specific name *terebinthacea* (1833) is much older than *macrophylla* (1841), and even where Nuttall transferred the former from *Heliopsis* to *Balsamorrhiza* it has page priority. If united, *B. terebinthacea* should be the species and *B. macrophylla* the variety.

Balsamorrhiza floccosa Rydb. and *B. tomentosa* Rydb. were reduced to synonyms of *B. incana* and *B. sagittata* respectively. It may be admitted that they (especially *B. tomentosa*) are closely related to the species to which they are referred, but I doubt if the authors of the New Manual have seen authentic material of either. In the Bulletin of the Torrey Botanical Club, November, 1900, I gave a synopsis of the Rocky Mountain species of this genus, and have not found any material change to make since that time.

Gymnolomia linearis sp. nov.

Perennial with a rootstock or slender caudex; stems 3–4 dm. high, terete, strigose; leaves opposite, short-petioled, narrowly linear, 3–4 cm. long, 2–4 mm. wide, entire, hirsutulous, indistinctly 3-nerved, sparingly hispid-ciliate at the base; heads long-peduncled; involucres about 6 mm. high, 12–15 mm. broad; bracts linear-lanceolate, canescent-strigose; rays 10–12 mm. long, 3–4 mm. wide.

This species resembles *Gymnolomia longifolia* and *G. annua* in leaf form and general habit, but it is a perennial. From *G. multiflora* it differs in the narrow leaves and the slender perennial base, which would be classified rather as a rootstock than a caudex. The type number was included in *G. multiflora* by Robinson and Greenman* as a narrow-leaved form. The other specimens cited by them as belonging to this form, I have not seen, but probably they should be included in *G. linearis*.

UTAH: St. George, 1877, *E. Palmer* 241 (type, in herb. Columbia Univ.).

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*Proc. Boston Soc. Nat. Hist. **29**: 92. 1899.

Gymnolomia ciliata (Robins. & Greenm.) Rydb. sp. nov.

Gymnolomia hispida, var. *ciliata* Robins. & Greenm. Proc. Boston Soc. Nat. Hist. **29**: 93. 1899.

HELIANTHUS

The authors of the New Manual have reduced *Helianthus aridus* Rydb. to a synonym of *H. petiolaris*. Although the forms of its leaves resemble those of that species, *H. aridus* is much more closely related to *H. lenticularis* (*H. annuus* of the Manual), which is indicated by the form of the bracts and the pubescence. If it should be reduced at all, it should be made a variety of *H. lenticularis*. It may even be a depauperate form of that species.

Helianthus giganteus is omitted, although unquestionable specimens have been collected in Colorado. (See my Flora of Colorado, page 372.)

HELIANTHELLA

In the New Manual *Helianthella uniflora* is described in the key as having a purple disk. In all specimens I have seen the disk-corollas are yellow. *H. Douglasii* is not included in the flora, although it has been collected in Montana by F. W. Anderson and Tweedy, in the Yellowstone Park by Tweedy, and south thereof in Wyoming by C. C. Curtis. (See also my Flora of Montana and the Yellowstone National Park.)

ENCELIOPSIS

Enceliopsis nutans (Eastwood) A. Nels., from Colorado and Eastern Utah, is omitted in the New Manual. This is strange, as Professor A. Nelson is the author of the name *Enceliopsis* as well as of the combination *E. nutans*.

BIDENS

Bidens bipinnata L. is included in Coulter & Nelson's New Manual. I have not seen any specimens from the Rocky Mountain region that could be referred to that species. *B. Bigelovii* is, however, found in Colorado. *Crandall 2726*, *Shear 4587*, *Clements 64* and *82*, all resemble so closely the Mexican Boundary Survey *no. 582* and *no. 582a*, from which *B. Bigelovii* was described, that there is no doubt about the identity. Duplicates of these two numbers of the Boundary Survey are in both the herbarium of the Columbia University and that of the New York Botanical Garden. The structure of the marginal achenes distinguishes *B. Bigelovii* at once from *B. bipinnata*.

THELESPERMA

In the description of *Thelesperma ambiguum* in Coulter & Nelson's New Manual, we find the following: "bracts of the outer involucre 8, subulate-linear, almost equalling or half the length of the inner," etc. In Wright's specimens, from which *T. ambiguum* was described, the outer bracts are ovate or elliptic, scarcely one fourth as long as the inner involucre. What is described in the New Manual is evidently *T. intermedium* Rydb. When I described the latter, I had known it for about ten years and had never been able to make it agree with Dr. Gray's description of *T. ambiguum* in the Synoptical Flora. In the original publication of *Thelesperma ambiguum* no diagnosis is given, only a few characters distinguishing it from related species. In habit *T. ambiguum* resembles most *T. subnudum*, having the creeping rootstock of that species, the long naked peduncles, and the leaves found near the base of the stem only. The range is given as Montana to New Mexico and Texas. This was probably taken from the Synoptical Flora. The specimens on which Dr. Gray extended the range to Montana belong to *T. marginatum*, in many respects closely related to *T. ambiguum* but with discoid heads. *T. ambiguum*, as far as I know, is not found north of southern Colorado. *T. intermedium*, which is really described under the name of *T. ambiguum* in the New Manual, does not have a "creeping rootstock" (as Gray described *T. ambiguum*) but has a biennial or perennial taproot; and it has a leafy stem. As the authors of the New Manual did not at all consider the differences in the subterranean parts of *T. ambiguum* and *T. intermedium*, it was natural that they would not consider the same parts in *T. trifidum* and *T. tenue*, which resemble each other much more closely, and we find the latter as a synonym of the former. *Thelesperma marginatum* Rydb. is ignored altogether, although in my Flora of Montana four collections from that state are cited.

HYMENOPAPPUS

Professor Nelson divides this genus into two groups: one with stems leafy throughout, mostly corymbosely branched and with numerous heads; the other with stems leafy below, the leaves reduced upwards, few or wanting, heads not numerous. In the first group, he places *Hymenopappus tenuifolius* and *H. luteus*. The first of these two always has a leafy stem and many heads, but in *H. luteus* the stem is not more leafy than it often is in *H. filifolius* and *H. cinereus*, and as a rule has less numerous heads than either of them. In the key of the New Manual *H. scaposus* is distinguished from the rest by the following character: "stem scapose, less than 2 dm. high." These characters we often find in both *H. luteus* and *H. araneosus*.

Hymenopappus cinereus Rydb. and *H. ochroleucus* Greene are made synonyms of *H. araneosus*. I take the two first to be the same, but think that the last one should be kept distinct. It is characterized by the denser, more permanent tomentum, a tuft of dense matted white tomentum on the caudex, and achenes with silky and more appressed pubescence. This is characteristic of neither *H. cinereus* nor *H. ochroleucus*. *Hymenopappus parvulus* Greene is made a synonym of *H. scaposus*, but it has a smaller head, no matted white tomentum on the caudex and subcylindraceous corolla-throat. The last character would associate it with *H. macroglottis*, *H. lugens*, and *H. eriopodus*, but its corollas are scarcely more than half the size of those of the other species. *H. scaposus* is not found in the region, as limited in the New Manual.

Hymenopappus lugens Greene is to be added to the region, having been collected above Marysvale, Utah, July 21, 1905, *Rydberg & Carlton 7049*, and *H. eriopodus* A. Nels., found in Diamond Valley, May 19, 1902, *Goodding 880*, and at Springdale, May 14, 1894, *Jones 5261*. The last has much broader segments to the leaves than the type and resembles *H. tomentosus* in habit, but has the corolla of *H. eriopodus*. It may prove to be distinct.

OTHAKE

In describing *Polypteris maxima*, Dr. J. K. Small overlooked the fact that the original *Palafoxia Hookeriana* was based on Drummond's plant, which he referred to *Polypteris maxima*. Mr. Bush, in reëstablishing Rafinesque's genus *Othake* did not notice this discrepancy and the name *Othake Hookerianum* has hitherto been applied to the wrong species. The synonymy of the two species is as follows:

OTHAKE HOOKERIANUM (T. & G.) Bush, Trans. Acad. Sci. St. Louis **14**: 177. 1904

Palafoxia texana Hook. Ic. Pl. *pl.* 148. 1837. Not *P. texana* DC. 1836.

Palafoxia Hookeriana T. & G. Fl. N. Am. **2**: 368. 1842.

Polypteris maxima Small, Fl. SW. U. S. 1288. 1903.

Othake maximum Bush, Trans. Acad. Sci. St. Louis **14**: 179. 1904.

Both Hooker's description of *Palafoxia* and Torrey and Gray's description of *P. Hookeriana* were based on Drummond's specimens, of which there is a duplicate in the Columbia herbarium, and this belongs to *Polypteris maxima* Small. Hooker's plate also illustrates the same thing. It was not strange that Dr. Small was led astray, for the true *O. Hookerianum* is a very rare plant and it was natural to think that the common plant which had been taken for it by Gray, Porter, Coulter, Greene, A. Nelson, myself, and others, should be regarded as *O. Hookerianum.* The latter species should be known as

Othake sphacelatum (Nutt.) Rydb. nom. nov.

Stevia sphacelata Nutt.; Torr. Ann. Lyc. N. Y. **2**: 214. 1827.

Palafoxia Hookeriana subradiata T. & G. Fl. **2**: 368. 1842.

Polypteris Hookeriana A. Gray, Proc. Am. Acad. **19**: 30, mainly.

Othake Hookerianum Bush, Trans. Acad. Sci. St. Louis **14**: 177, as to the description. 1904.

Bush gives as a doubtful synonym *Othake longifolium* Raf.,* but the description does not fit this plant. *O. longifolium* is compared with *O. tenuifolium* Raf., *i. e.*, *Othake callosum* (Nutt.) Bush, and said to be much smaller in every respect than that species. *O. sphacelatum* has about twice as large heads as *O. callosum.*

Torrey's description of Nuttall's *Stevia sphacelata* is rather poor and not ample enough to recognize any species by, but the type, collected by James, is in the old Torrey herbarium and it is un-

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*New Fl. Am. **4**: 74. 1838.

mistakably the plant here considered. Being the only available and certain specific name of the plant, *sphacelatum* is therefore taken up.

Othake macrolepis sp. nov.

Annual; stem 3–4 dm. high, strigose-puberulent, and glandular on the upper parts, with ascending branches; leaves alternate, linear, indistinctly 1-ribbed, strigose-puberulent on both sides, 3–5 cm. long, 2–3 mm. wide, short-petioled; involucres obconic, 9–10 mm. high and about as wide; bracts 8–12, in two subequal series, linear-oblanceolate, abruptly acute, scabrous-hispidulous and slightly glandular, green, with scarious tips, and the inner with narrow scarious margins; rays none; disk-corollas rose-purple, 14–15 mm. long; limb 4–5 mm. long, with linear lobes; achenes linear-obpyramidal, 7 mm. long, 1 mm. thick at the apex, strigose-canescent, pappus-scales 6–8, lanceolate, caudate-acuminate 5–6 mm. long.

This species is most closely related to *O. roseum* Bush, but has much larger heads, flowers, and fruit, and the leaves have a less distinct midrib. In the type of *O. roseum* the disk-corollas are only about 12 mm. long. There is no full-grown fruit in the type sheet, but other specimens show that the achenes are only 4–5 mm. long and their pappus-scales 2–3 mm. long, acute rather than caudate.

COLORADO: Rule Creek, Bent Co., Aug. 17, 1909, *G. E. Osterhout 4097* (type, in herb. N. Y. Bot. Gard.).

PICRADENIOPSIS

In the New Manual, my genus *Platyschkuhria* is accepted, but *Picradeniopsis* Rydb., fully as distinct from *Bahia*, is retained in the latter genus. In *Picradeniopsis* and *Achyropappus* the foliage is impressed-punctate, and the leaves opposite, which is not the case in the other genera included by Gray in *Bahia*. *Bahia* is a shrubby plant of South America with white rays. Using Professor Nelson's generic key, *Picradeniopsis* would key into *Hymenoxys*. It stands nearest to that genus, which has been known under the name *Picradenia*, but differs in the free bracts. *Picradeniopsis* is amply distinct from the non-punctate and alternate-leaved *Bahia* but may have been included in *Achyropappus*. The annual habit and rayless heads of that genus seem to be distinction enough.

Picradeniopsis Woodhousii (A. Gray) Rydb. comb. nov.

Achyropappus Woodhousii A. Gray. Proc. Am. Acad. **6**: 546. 1865.
Schkuhria Woodhousii A. Gray, Proc. Am. Acad. **9**: 199. 1874.
Bahia Woodhousii A. Gray, Syn. Fl. 1^2: 333. 1884.

Dr. Gray in the work last cited includes this species in the annual species of *Bahia*. The plant is, however, perennial with a creeping rootstock, and in habit so closely resembling *P. oppositifolia* that it is often hard to distinguish the two. The flowers are of a much lighter color in *P. Woodhousii*, the rays being ochroleucous or straw-colored, and the pappus-scales are much narrower, lance-subulate, and only slightly scarious-margined.

This should have been included in the New Manual, as the type was collected in northern New Mexico.

PLATYSCHKUHRIA

Platyschkuhria oblongifolia (A. Gray) Rydb. should have been included in Coulter & Nelson's New Manual. It has been collected in southwestern Colorado. See Gray's Synoptical Flora 1^2: 332, and my Flora of Colorado 377.

Platyschkuhria desertorum (Jones) Rydb. comb. nov.

Bahia desertorum M. E. Jones, Zoe **2**: 249. 1891.

This species is a close ally to *P. integrifolia*, differing mainly in the acuminate bracts.

VILLANOVA

By an oversight *Bahia dissecta* (A. Gray) Britton (*B. chrysanthemoides* A. Gray) was retained in *Bahia* in my Flora of Colorado. It should have been restored to *Villanova*. As nobody seems to have used this generic name in connection with the earliest specific one, the plant should be known as:

Villanova dissecta (A. Gray) Rydb. comb. nov.

Amauria ? dissecta A. Gray, Mem. Am. Acad. **4**: 104. 1849.
Villanova chrysanthemoides A. Gray, Pl. Wright **2**: 96. 1853.
Bahia chrysanthemoides A. Gray, Proc. Am. Acad. **19**: 28. 1883.
Bahia dissecta Britton, Trans. N. Y. Acad. Sci. **8**: 68. 1889.

CHAENACTIS

Chaenactis achilleaefolia H. & A. and *C. pedicularia* Greene are both reduced in the New Manual, the former to a variety of *C. Douglasii*, the latter to a synonym of *C. alpina*. I think that both should be kept up as species. The characters separating the former from *C. Douglasii* are not so much the dwarf habit and reduced crowded segments of the leaves, for such conditions are found in the true *C. Douglasii*, as the permanent tomentum and the longer and acute pappus-scales. *C. alpina* is subscapose with peduncles 2–7 cm. long and its involucre is much shorter than the corollas. *C. pedicularia* has leafy although short stems, very short peduncles 1–2 cm. long, and involucral bracts, in the specimens seen, fully as long as the flowers. Apparently *C. pedicularia* is the same as *C. Douglasii*, var. *montana* M. E. Jones,* of which the author states that it has been confused with *C. alpina*, but at the same time points out several distinctions.

CHAMAECHAENACTIS

In reviewing Coulter & Nelson's New Manual, Dr. B. L. Robinson† stated: "No mention, for instance, is made of *Encelia nutans* Eastwood and *Chaenactis scaposa* Eastwood." This is not exactly true, for the latter is included in the New Manual. It was not strange, however, that Dr. Robinson should overlook the fact, for who would expect to find it under the name *Actinella carnosa* A. Nels.? I doubt if Professor Nelson has seen any specimens, for if he had I do not think he would have transferred it to *Actinella*. The description in the New Manual is a verbatim copy of Miss Eastwood's description. The plant is evidently more closely related to *Chaenactis*, in which genus it was first placed, than to *Actinella*. If Professor Nelson was unwilling to adopt my generic name *Chamaechaenactis*, it would have been much better to retain the species in *Chaenactis* than to transfer it to *Actinella*, where it is wholly out of place. Besides, *Chamaechaenactis* is fully as good as Nelson's own genera *Tonestus* and *Wyomingia*, and far more so than *Nacrea* and *Enomegra*. The last has no scientific standing at all, being distinguished from *Argemone* only by the yellow instead of milky white sap. In which genus should a species with ochroleucous or white sap, turning yellowish, be placed?

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* Proc. California Acad. Sci. II. **5**: 700. 1895.

†Rhodora **12**: 16. 1910.

Correction

The California specimens referred to *Scutellaria veronicifolia* in a previous installment of the studies belong to *S. californica* A. Gray, and not to the former, having a different corolla.

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STUDIES OF WEST INDIAN PLANTS—III

By NATHANIEL LORD BRITTON

NEW YORK
1910

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL
CLUB 37: 345-363. 29 Jl 1910

[From the BULLETIN OF THE TORREY BOTANICAL CLUB, 37: 345-363. 1910.]

Studies of West Indian plants — III

NATHANIEL LORD BRITTON

12. THE WEST INDIAN SPECIES OF COMOCLADIA P. BR.

COMOCLADIA* P. Br.; L. Syst. ed. 10, 861. 1759

Type species: *Comocladia pinnatifida* L.

1. Leaves entire or undulate.
  - A. Glabrous species.
    - *a.* Lateral leaflets distinctly stalked.

1. COMOCLADIA PINNATIFIDA L. Syst. ed. 10, 861. 1759

Comocladia integrifolia Jacq. Enum. Pl. Carib. 12. 1760.

TYPE LOCALITY: Jamaica.

Both names are based wholly on P. Browne, Hist. Jam. 124, where the generic name is printed *Comocladia.* Browne refers to Sloane's description and figure of "Prunus racemosa, caudice non ramosa" (Hist. Jam. 2: 131. *pl. 222. f. 1*); the illustration there given is not wholly satisfactory for the plant which has been taken for this species, but which is here accepted as usually interpreted.

DISTRIBUTION: Moist woodlands at middle and lower elevations throughout Jamaica; Haiti and Santo Domingo.

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*The spelling of the generic name was changed by Linnaeus to *Camocladia,* but this form is here regarded as a typographical error, although it was continued by Linnaeus, in the second edition of Species Plantarum, and in successive editions of the Systema, but was changed back to the original by Gmelin (Syst. ed. 13. 1791). The original spelling was accepted by Jacquin, by Swartz, and by most subsequent authors.

2. **Comocladia Hollickii** sp. nov.

Low, flowering when not more than 1 m. high, the tallest plants seen not more than 3 m. high. Leaves 3–4 dm. long, glabrous; leaflets 17–21, distinctly petioluled, subcoriaceous in texture, undulate-dentate with acutish teeth, acuminate at the apex, obtuse or truncate at the base; lower leaflets ovate, 3–5 cm. long, middle leaflets (5 or 6 pairs) ovate-lanceolate to oblong, 6–9 cm. long, terminal leaflet broadly lanceolate, long-petioluled, 6–8 cm. long; petiolules of the lateral leaflets 1.5–3 mm. long; petioles 3–6 cm. long; inflorescence glabrous, short, about 8 cm. long, sparingly branched, narrow; pedicels 1 mm. long or less; corolla-buds 0.5 mm. in diameter, purple; sepals and petals obtuse, rounded; filaments twice as long as the anthers.

Rocky hillside, Bluefields Mountain, Jamaica, at 500 m. altitude (*Britton & Hollick 2000*, March, 1908, type); wooded hill, Potsdam, Santa Cruz Mountains, Jamaica (*Britton 1271*).

3. **Comocladia grandidentata** sp. nov.

A slender tree, up to 10 m. high. Leaves glabrous, about 8 dm. long; leaflets about 29, petioluled, thin in texture, coarsely irregularly dentate with obtuse or acutish teeth, acute or abruptly acuminate at the apex, obtuse or subtruncate and more or less oblique at the base, the lower 4 or 5 pairs ovate, 3.5–6 cm. long, the others oblong, oblong-lanceolate or somewhat oblong-oblanceolate, 7–11 cm. long, 2.5–4 cm. wide; lateral petiolules 2–3 mm. long; flowers and fruit unknown.

Hopeton, Westmoreland (*Harris 9944*, Sept. 19, 1907).

4. COMOCLADIA EHRENBERGII Engler, Bot. Jahrb. 1: 420. 1881

TYPE LOCALITY: Santo Domingo.

DISTRIBUTION: Santo Domingo.

Note.—Known to me only from the description. A glabrous species, its leaves with only two pairs of entire ovate short-petioluled leaflets.

b. Lateral leaflets sessile or subsessile.

5. **Comocladia parvifoliola** sp. nov.

A tree, up to 10 meters high, glabrous throughout. Leaves 1–2 dm. long; leaflets 7–11, coriaceous, entire, sessile, or on petiolules 1 mm. long or less, rounded or subcordate at the base, acute or bluntly short-acuminate at the apex, the lowest pair ovate, 2–4 cm. long, the others oblong or oblong-lanceolate, 4–7 cm. long; panicles very slender, as long as the leaves or longer; flowers minute; sepals broadly ovate, obtuse; petals twice as long as the sepals, oval-orbicular, rounded; stamens a little shorter than the petals.

Woodlands, Dolphin Head Mountain, Jamaica (*Britton 2473*, March, 1908, type; *Harris 10,267*).

6. COMOCLADIA CORDATA N. L. Britton, Torreya 7: 6. 1907

TYPE LOCALITY: Troy, Jamaica.

DISTRIBUTION: Known only from the type locality.

B. Pubescent species.

a. Lateral leaflets distinctly stalked.

7. COMOCLADIA PUBESCENS Engler, Bot. Jahrb. 1: 420. 1881

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Jamaica, in woodlands at lower and middle elevations in relatively moist districts.

8. **Comocladia jamaicensis** sp. nov.

Low, about 2 meters high. Leaves 3–4.5 dm. long, the rachis loosely pilose; leaflets about 21, thin in texture, distinctly petioluled, obtuse or subtruncate at the base, acute to acuminate at the apex, glabrous above, sparingly pubescent on the veins beneath, undulate-dentate or some of them nearly entire; lateral petiolules 2–3 mm. long; lower two or three pairs of leaflets ovate, 3–5 cm. long, the others lanceolate, ovate-lanceolate or oblong, 5–10 cm. long, 1.5–4 cm. wide; inflorescence puberulent, shorter than the leaves, about 3 dm. long, its branches short and slender; sepals and petals obtuse; young stamens with filaments not longer than the anthers.

On dry rocky hill, Green Island, Jamaica (*Britton & Hollick 2132*, March, 1908, type; *Harris 10,250*).

b. Lateral leaflets sessile or subsessile.

9. COMOCLADIA VELUTINA N. L. Britton, Torreya 7: 6. 1907

TYPE LOCALITY: Great Goat Island, Jamaica.

DISTRIBUTION: Jamaica, on very dry rocky hillsides and sand dunes near the southern coast, Healthshire Hills to Great Pedro Bay.

Note.—Recorded by Grisebach from Jamaica as *C. propinqua*, which it little resembles.

10. **Comocladia pilosa** sp. nov.

A tree, 6 meters high, the young twigs, leaves, and inflorescence densely pilose-pubescent. Leaves about 7 dm. long; leaflets about 19, chartaceous, dark green above, paler beneath, entire-margined, the lateral ones sessile, or on petiolules about 1 mm. long, cordate or subtruncate at the base, obtuse, acutish or abruptly short-acuminate at the apex; lowest pair of leaflets suborbicular, 4–5 cm. long; second and third pairs ovate-orbicular, 5–8 cm. long, the others oblong or ovate-oblong, 9–14 cm. long, 4–5 cm. wide; terminal leaflet long-stalked; panicles several, shorter than the leaves, 2.5 dm. long or less, the branches rather stout; calyx with a few scattered hairs, the sepals rounded; petals a little longer than the sepals, rounded; filaments twice as long as the anthers.

Wooded hill, Union Hill, near Moneague, Parish of St. Ann's, Jamaica (*Britton & Hollick 2762*, April, 1908).

11. COMOCLADIA UNDULATA Urban, Symb. Ant. **5**: 401. 1908

TYPE LOCALITY: Martinique.

DISTRIBUTION: Known only from Martinique.

2. Teeth of the leaves bristle-tipped.
   A. Glabrous species.

12. COMOCLADIA PLATYPHYLLA A. Rich.; Griseb. Cat. Pl. Cub. 68. 1866

TYPE LOCALITY: Cuba [*Rugel 277*, the type specimen, is from Matanzas].

DISTRIBUTION: Cuba, at lower altitudes, provinces of Oriente, Camagüey, Santa Clara, Matanzas, and Havana.

Note.—Lower leaflets ovate, the others mostly oblong. Engler (DC. Mon. Phan. **6**: 365) describes a specimen with all the leaflets ovate, long-stalked, and with only 3 or 4 teeth on each margin. The number of teeth is often 9 on each margin. The species consists of a number of races, differing in width of leaflets, length of petiolules and number of teeth on the leaf-margins, the extremes appearing quite different from each other.

A. Richard (in Sagra, Hist. Cub. **10**: 155. 1850) remarks as follows concerning this species, which was subsequently described by Grisebach:

"I have observed an example of this tree, but without flowers, which, it seems to me, could form, if not a distinct species, which I am not far from believing, at least a very notable variety. The leaflets are almost as large as the leaves of the 'castaño,' are also rough on both faces, dentate and spine-like in their contour; and, in short, recall in all their shape the leaflets of *Comocladia dentata*, but are much larger and rougher. If the opportunity comes to see this plant with flower and fruit it will perhaps be possible to form a distinct species to which the name *Comocladia platyphila** will apply perfectly."

13. COMOCLADIA INTERMEDIA C. Wright; Engler in DC. Mon. Phan. 4: 366. 1883

TYPE LOCALITY: Cuba. [Wright's specimen in the Kew Herbarium is from Trinidad, Cuba.]

DISTRIBUTION: Southern coast of Santa Clara Province, Cuba, in dry districts.

14. **Comocladia acuminata** sp. nov.

Leaves about 1 m. long, glabrous. Leaflets about 31, chartaceous, short-petioluled, the lowest ovate to ovate-lanceolate, 5–6 cm. long, the others oblong-lanceolate, 10–14 cm. long, 3–4 cm. wide; slenderly acuminate at the apex, broadly cuneate at the base, serrate with about 8 bristle-tipped teeth on each margin, the veins prominent on the underside, diverging nearly at right angles from the slender midvein, the under surface paler green than the upper; panicles 4 dm. long, glabrous, slender, their branches widely diverging, 8–12 cm. long; flowers 4-parted, about 1.5 mm. broad.

Santo Domingo (*Wright, Parry & Brummel 192*, in United States National Herbarium).

B. Pubescent species.

15. COMOCLADIA GLABRA Spreng. Syst. 1: 176. 1825

TYPE LOCALITY: Porto Rico.

DISTRIBUTION: Porto Rico, at lower and middle elevations

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*Doubtless a misprint for *platyphylla*.

in moist and wet districts. Recorded by Engler from Santo Domingo and from Cuba.

The inflorescence, leaf-rachis, and venation of this species are sparingly pubescent. The races differ greatly in the length of the spiny tips of the teeth of the leaflets.

16. COMOCLADIA DENTATA Jacq. Enum. Pl. Carib. 12. 1760

Comocladia propinqua H. B. K. Nov. Gen. 7: 16. 1824.

Comocladia dentata propinqua Engler, in DC. Mon. Phan. 4: 364. 1883.

TYPE LOCALITY: Near Havana, Cuba (according to Jacq. Stirp. Am. 13. *pl.* 173).

DISTRIBUTION: Woodlands at lower elevations, provinces of Camagüey, Havana, Matanzas, and Santa Clara, Cuba, ascending to 420 meters on the Trinidad Mountains; Santo Domingo.

Field observations indicate that *Comocladia dentata* and *C. propinqua* can not be held as distinct species; the leaflets vary from narrowly lanceolate to broadly ovate, and from sharply spinulose-dentate to nearly or quite entire. The tree becomes 6 meters high in Santa Clara, Cuba.

Note.— *Comocladia dentata brevifolia* Engler, in DC. Mon. Phan. 4: 364. 1883.

I have not seen this plant, described as from "Domingo" it may be the same as the following species.

17. **Comocladia domingensis** sp. nov.

Twigs densely short-pubescent. Leaves about 2 dm. long, the rachis densely short-pilose; leaflets 17–19, ovate to ovate-elliptic, sessile, chartaceous, obtuse at the apex, rounded or subtruncate at the base, glabrous and rather dark green above, pilose on the prominent veins and light green beneath, the lower ones 1.5–2.5 cm. long, the others 4–5 cm. long, 2–3 cm. wide, serrate with 7 or 8 spinulose-tipped teeth on each margin and spinulose at the apex; panicles narrow, slender, loosely pilose, about 13 cm. long; flowers 4-parted; sepals orbicular, 0.5 mm. long; petals ovate, obtuse, 1 mm. long; stamens much shorter than the petals.

Santo Domingo (*Wright, Parry & Brummell 190*, in United States National Herbarium).

18. **Comocladia Dodonaea** (L.)

Ilex Dodonaea L., Sp. Pl. 125. 1753.

Comocladia tricuspidata Lam. Mém. Acad. Sci. Paris **1784**: 347. 1787.

Comocladia ilicifolia Sw. Prodr. 17. 1788.

Type locality: "America meridionalis."

Plumier's *plate 118, f. 1*, identifies this species beyond doubt.

Distribution: Santo Domingo (according to Engler); Porto Rico, at low elevations in dry districts; Culebra; St. Thomas; St. Croix; Montserrat; Antigua; Guadeloupe; Mustique Island, Grenadines.

Note.—This species is the monotype of the genus *Dodonaea* (Plum.) Adans. 1763.

13. THE GENUS VIBURNUM IN JAMAICA

1. Viburnum villosum Sw. Prodr. 54. 1788

Hillsides and woodlands in moist and wet districts, at middle and higher altitudes, ascending to 2300 meters in the Blue Mountains.

The species apparently consists of numerous races, differing in the amount of stellate pubescence, in the shape of the fruit, and in the length of the stamens. Very densely tomentose bushes grow in proximity to slightly pubescent ones about Cinchona.

2. **Viburnum arboreum** sp. nov.

A tree, 15 m. high, with a straight trunk and spreading branches. Leaves chartaceous, entire, oval-elliptic, dull green, glabrous or sparingly stellate-pubescent above, loosely stellate-pubescent beneath, 8–12 cm. long, 5–6.5 cm. wide, short-acuminate at the apex, unequally narrowed or obtuse at the base, the veins about 6 on each side of the midvein, the stout petioles stellate-pubescent, 1–2 cm. long, inflorescence stellate-pubescent, 8–12 cm. broad; fruiting pedicels 3 mm. long or less; fruit oblong, 9–10 mm. long and 3 mm. thick when dry, narrowed at both ends, crowned by the ovate acute ciliate calyx-lobes and tipped by the base of the style.

Wooded rocky hill, Tyre, Cockpit Country (*Britton*, Sept. 13–18, 1906, *no.* 553, *type; Harris 9475*). *Harris 9403* from the same region, a shrub with white flowers, is probably this species.

3. VIBURNUM ALPINUM Macf. Fl. Jam. 2: 201. 1850

Hillsides and woodlands at middle and higher elevations in both relatively dry and wet districts, ascending to at least 1800 meters in the Blue Mountains. Erroneously regarded by Grisebach as identical with *V. glabratum* H.B.K. of Mexico and South America.

14. HITHERTO UNDESCRIBED SPECIES OF JAMAICA

Thrinax Rex Britton & Harris, sp. nov.

Trunk up to 20 meters high, cylindric, 2–2.5 dm. in diameter, sometimes swollen at the base. Leaf-blades of middle-sized trees 3 m. broad, silvery beneath, those of young plants sometimes 4 m. broad; leaf-segments 40–50, united to about one half, 3–5 cm. wide, notched at the apex into rigid acuminate narrow lobes 1–3 cm. long, revolute-margined, the midrib prominent on the under side; petioles very stout, compressed, 2-edged, as long as the blades or longer; ligule triangular, acute, 2–2.5 cm. long; inflorescence glabrous, much shorter than the leaves; bracts oblong, puberulent, with a triangular-acute apex; ultimate branches of the inflorescence rather stout, 10–12 cm. long; pedicels stout, 1.5–2 mm. long, about twice as long as the triangular acuminate bractlets; calyx hemispheric-campanulate, minutely toothed; fruit subglobose, 6–7 mm. in diameter; seeds brown, globular, shining, very nearly smooth, 5 mm. in diameter.

Eastern slopes of the John Crow Mountains at 450 to 600 meters altitude (*Britton 4151; Harris & Britton 10,759*).

Chamaecrista fasciata sp. nov.

Herbaceous, the roots apparently annual, the stems slender, erect, little-branched, 5–10 dm. high, more or less pubescent with long curled hairs. Leaves 8 cm. long or less, short-petioled; leaflets 20–40, linear-lanceolate, inequilateral, rounded at the base, acute and aristulate at the apex, strongly veined, ciliolate, but otherwise nearly glabrous, 10–12 mm. long, 1.5–2 mm. wide; stipules lanceolate-attenuate, strongly veined, 8–10 mm. long; gland scutellate, sessile, 0.5 mm. wide, borne on the petiole below the lowest pair of leaflets; peduncles a little shorter than the petioles, villous, the bracts ovate-acuminate, about 4 mm. long; sepals lanceolate, acuminate, villous on the back, about one half as long as the petals; flowers 1.5 cm. broad; ovary and young pod densely long-villous; mature pod linear, a little curved, somewhat narrowed toward the base, 4–5 cm. long, 5–6 mm. wide, obliquely short-beaked, loosely villous, black-banded over the spaces between the seeds and along both margins.

Bank, between Bath and Cuna-Cuna Gap, at 300 m. altitude (*Britton 3500*, September, 1908).

Meibomia umbrosa sp. nov.

Stem trailing, sometimes 1 m. long, densely villous to the base. Leaflets ovate to ovate-lanceolate, 6–10 cm. long, acute or acuminate at the apex, the lateral ones short-stalked, obliquely obtuse at the base, the middle one narrowed or blunt at the base and longer-stalked, all finely and rather densely pubescent beneath, sparingly pubescent above; petioles about as long as the leaflets, densely villous; stipules lance-subulate, about 1 cm. long; peduncles arising in the lower axils, as long as the leaves or longer, slender, pubescent, bearing a few distant lance-subulate bracts; flowers purple; fruiting racemes 1 dm. long or longer, the filiform pedicels spreading, about 2 cm. long; loment 1–3-jointed, the upper suture undulate; loment-joints obliquely oblong, nearly separated, uncinate, about 8 mm. long and 5 mm. high.

Shaded grassy hillside, Troy, Jamaica (*Britton 444*, Sept. 13–18, 1906, type); woodlands near Newport, Manchester (*Britton 3209*); nearest to *M. axillaris* (Sw.) Kuntze, which is nearly glabrous, with blunt leaflets.

Cissus (?) cucurbitacea Britton, sp. nov.

A woody, high-climbing vine, the stem up to 7.5 cm. thick at the base, the twigs and leaves fleshy. Leaves triangular-ovate, 6–10 cm. long, cordate at the base with a widely open sinus, 5-nerved and pinnately veined, remotely dentate with apiculate teeth, scabrous on both sides with short stiff hairs or when old papillose, the petioles 2–3 cm. long; tendrils slender, 1–2 dm. long.

Dry rocky hillside, Fort Henderson, Jamaica (*Britton & Hollick 1812*, March 2, 1908, type); base of Healthshire Hills (*Harris & Britton 10,512*).

An interesting xerophytic vine, of which we do not yet know either flowers or fruit.

Xylophylla contorta sp. nov.

A much branched shrub about 1 m. high, the main branches terete, the twigs flat and 2-edged. Phyllodes pale green, linear, 5–7 mm. wide at the middle, 6–10 cm. long, narrowed to both ends, acutish, many of them curved or falcate, finely and closely striate, the upper ones floriferous to below the middle, the crenatures 1-flowered, distant; stipules triangular-lanceolate, 2 mm. long or less; pedicels of pistillate flowers 3.5–4.5 mm. long, very slender, thickened above, sepals broadly ovate, obtusish, about 1 mm. long; fruit depressed, 3-lobed, obscurely reticulated, 3.5 mm. wide, nearly 2 mm. high; seed obovoid, 1.5 mm. long, minutely black-dotted.

Dry hillside, St. Ann's Bay (*Britton 2515*, March, 1908).

Tricera macrophylla sp. nov.

An erect virgate simple or sparingly branched shrub 1–2 meters high, with rough bark. Leaves narrowly elliptic or lanceolate-elliptic, very large for the genus, flat, 15–24 cm. long, 5–8 cm. wide, subcoriaceous, acute at both ends, the midvein stout, prominent beneath, impressed above, the veins numerous, slender, diverging nearly at right angles from the midvein and connected at 2–3 mm. from the margin, the ultimate venation finely and strongly reticulated, the stout petiole 1–1.5 cm. long; capsules brown, finely pubescent, 7–8 mm. long, woody, their recurved beaks 2 mm. long; inflorescence very short-stalked, lateral and supra-axillary; seeds linear-oblong, shining, 5 mm. long.

Woodlands, eastern and southeastern slopes of the John Crow Mountains at 500 meters altitude (*Harris & Britton 10,770*, March 11, 1909, type; *Britton 4173*, *4193*).

Clusia silvicola sp. nov.

A tree, 12 m. high. Leaves firm, obovate, 13 cm. long, 7–8 cm. wide, firm, thick, dull, inconspicuously veined, rounded at the apex, cuneate-narrowed at the base, the midvein rather prominent beneath, the stout petiole 1 cm. long; fruit ovoid, white, 7 cm. long, about 5 cm. thick; sepals 4, broad; bracts much smaller than the sepals; stigmas 8, sessile, oblong-obovate, 8 mm. long, 4–5 mm. wide, with a slight depression near the base.

Wooded hill near Dolphin Head, Hanover, 400 m. altitude (*Britton 2330*, March 18–20, 1908).

Homalium integrifolium sp. nov.

A tree, about 15 m. high, the foliage glabrous. Leaves oblong-lanceolate, 10–15 cm. long, 4 or 5 cm. wide, entire-margined or with a few low crenatures, chartaceous, attenuate-acuminate at the apex, obtuse or somewhat narrowed at the base, the midvein impressed above, rather prominent beneath, the primary veins about 12 on each side, the ultimate venation reticulated; petioles 6–8 mm. long; raceme 8–10 cm. long, its axis puberulent; pedicels 2–4 mm. long; hypanthium, sepals, and petals puberulent; sepals linear, acutish, 2.5 mm. long; petals ovate with a bluntish point, nearly 3 mm. long; stamens numerous; glands of the disk nearly contiguous; ovary depressed-globose.

Woodlands, eastern slopes of the southern end of the John Crow Mountains (*Harris & Britton 10,741*, March 10, 1909).

Anamomis grandis sp. nov.

A tree up to 13 meters high, the bark smooth, reddish, the branches gray, the young twigs sparingly pubescent. Leaves thin in texture, the blades pale green on both sides, not shining, copiously punctate, rather prominently veined, obovate, 4–6 cm. long, 2–4 cm. wide, obtuse or sometimes emarginate at the apex, narrowed or cuneate at the base, the midvein sparingly pubescent, impressed above, rather prominent beneath, the pubescent petioles 7–10 mm. long; peduncles slender, pubescent, 3–4 cm. long; cyme 3-flowered, the central flower sessile, the lateral ones on pubescent diverging pedicels 6 mm. long; hypanthium subglobose, appressed-pubescent; sepals concave, 2.5 mm. broad, rather broader than long, punctate, ciliate.

Dry rocky woodlands, Great Goat Island (*Harris 9307*).

Differs from *A. fragrans* (Sw.) Willd., of the Jamaica mountains, which has coriaceous, elliptic, shining, short-petioled leaves, and nearly erect pedicels.

Petesioides subverticillatum sp. nov.

A woodland shrub, 1–2 m. high, with slender branches. Leaves subopposite or subverticillate, sessile, oblong-elliptic to ovate-oblong, 5–14 cm. long, 6 cm. wide or less, cordate-clasping at the base with rounded auricles, acute or obtusish at the apex, indistinctly pinnately veined and slightly reticulated, punctate, the margins low-crenulate or entire; inflorescence bipinnate-paniculate, terminal, 4–6 cm. wide; pedicels rather stout, 1.5–3 mm. long; flowers 4-merous; calyx and corolla epunctate; staminate calyx 2.5 mm. long, its lobes semiorbicular-ovate, rounded, about one third as long as the tube; corolla as long as the calyx and similarly lobed; stamens nearly twice as long as the corolla; pistillate calyx 1 mm. long, the corolla a little shorter; staminodia half as long as the corolla; ovary ovoid; style short and stout;

fruit subglobose, red, 2.5 mm. in diameter, apiculate with the base of the style.

Woodlands, southeastern slopes of the John Crow Mountains, 350–600 m. altitude (*Harris & Britton 10,694*, type; *Britton 3937; Harris & Britton 10,701*); slopes, Cuna-Cuna Gap, *Britton 4049*)

Plumiera jamaicensis sp. nov.

An irregularly branched tree 8–10 m. high, the trunk up to 3 dm. in diameter. Leaves firm in texture, the blade elliptic, 12–15 cm. long, 5–7 cm. wide, rounded or emarginate at the apex, narrowed at the base, glabrous on both sides, or minutely puberulent on the veins beneath, the upper surface dark green with the veins somewhat impressed, the under surface lighter green with the broad nerves very prominent, diverging nearly at right angles from the strong elevated midvein, the ultimate venation strongly reticulated; petiole stout, 3–4.5 cm. long; peduncle stout, 18 cm. long or less; flowers numerous; bracts broadly ovate, acutish, 1.5 mm. long; pedicels 8–13 mm. long; calyx nearly truncate, with 5 short teeth; corolla white with a yellowish blotch at the base of each lobe, the tube 1 cm. long, the lobes 2–2.5 cm. long, oblong-obovate, obtuse; pods 15–22 cm. long, 1.5–2 cm. in diameter.

Coastal hillsides and thickets, parish of Portland. Wheelerfield, March 13, 1909 (*Britton 4123*, type); near Port Antonio, Sept. 25, 1906 (*Britton 870*). Near *P. emarginata* Griseb., of Cuba.

Valerianoides jamaicensis × mutabilis.

Hybrids are not often seen in the West Indian flora, but the one here recorded seems to be genuine. I found it growing near its parents on a roadside between Mandeville and Brown's Town, Manchester, with characters of foliage and flowers exactly intermediate.

Lantana jamaicensis sp. nov.

A vine, climbing on trees, up to 7 meters long, or shrubby and 1 meter high, or less, the branches long, slender, terete, densely puberulent. Leaves lanceolate to ovate, 2.5–9 cm. long, rather firm in texture, acute or acuminate at the apex, narrowed or rounded at the base, crenulate, sparingly pubescent above, densely puberulent and rather prominently veined beneath, or becoming glabrate, the petioles 1 cm. long or less; peduncles puberulent, 2–4 cm. long; heads involucrate, subglobose in flower, 1–1.5 cm.

in diameter, somewhat elongating in fruit; involucral bracts ovate to lanceolate, acutish, puberulent; corolla 6.5–10 mm. long, white or pale pink with a yellowish eye, puberulent, its lobes irregularly rounded; calyx-limb undulate, ciliate; stamens borne near the middle of the corolla-tube.

Banks and woodlands, Manchester and St. Elizabeth. Type from between Malvern and Stanmore Hill, Santa Cruz Mountains (*Britton 1097*, Sept. 3, 1907).

Apparently recorded by Grisebach as *Lantana stricta lilacina*, but it is not *Lantana lilacina* of South America. Certainly distinct from *Lantana stricta*.

Lantana arida sp. nov.

A widely branched shrub 1 meter high, or less, pubescent with long simple hairs and short glandular hairs intermixed; branches slender, 4-angled. Leaves ovate to oval, 1–2 cm. long, obtuse at both ends, or acutish at the apex, densely pubescent on both sides, rather firm in texture, crenate-dentate, the venation impressed above, prominent beneath, about 4 veins on each side of the midvein; petioles 2–3 mm. long; peduncles slender, longer than the leaves; inflorescence capitate; fruit oblong, 3–4 mm. long.

Dry rocky hillside, Salt Pond Hills, Kingston Harbor, in old fruit March 2, 1908 (*Britton & Hollick 1824*).

Rondeletia elegans sp. nov.

A tree, 5 m. high, the twigs densely appressed-pubescent. Leaves rather firm in texture, elliptic, the blades 11–16 cm. long, 9 cm. wide or less, glabrous above, sparingly pubescent on the veins beneath when old, quite densely pubescent beneath when young, acuminate at the apex, narrowed at the base, the midvein prominent beneath, with about 7 veins on each side, the stout pubescent petioles 2–4 cm. long; cymes axillary, pubescent, the peduncles about as long as the petioles; flowers all pedicelled; hypanthium hemispheric, pubescent, 1.5 cm. long; sepals narrowly lanceolate, pubescent, about as long as the hypanthium; corolla salverform, 10–14 mm. long, the cylindric crimson tube about twice as long as the 5 tawny-yellow obovate-orbicular undulate lobes; stamens sessile near the top of the corolla-tube; style 3 mm. long, pubescent below; fruit about 7 mm. long.

Woodlands, eastern slopes of the John Crow Mountains at 520 m. altitude (*Britton 4143*, March, 1909, type; *Harris & Britton 10,744*).

Rondeletia pallida sp. nov.

A tree, 10 m. high, the young foliage sparingly pubescent. Leaves thin, bright green, oblong-lanceolate to elliptic, 18 cm. long or less, 2–7 cm. wide, glabrous or with a few scattered hairs beneath and on the slender petioles when old, sharply acuminate at the apex, cuneate-narrowed at the base, the narrow midrib rather prominent on both sides with 4 or 5 pairs of veins on each side, the petioles 1–2 cm. long; cymes axillary; peduncles slender, a little shorter than the petioles; bractlets linear-lanceolate, pubescent, 2–3 mm. long; flowers in threes on the branches of the cyme, all on slender glabrous pedicels 3–5 mm. long; hypanthium hemispheric-campanulate, 1.5–2 mm. high; sepals triangular-lanceolate, acuminate, nearly as long as the hypanthium; corolla white or yellowish, fading brownish, 12–15 mm. long, salverform, glabrous or puberulent, the cylindric tube twice to three times as long as the 5 suborbicular, rounded, spreading lobes; stamens borne near the top of the corolla-tube, the filaments shorter than the anthers; style about 3 mm. long, pubescent below; stigma 2-lobed; fruit about 6 mm. long.

Woodlands, southeastern foothills of the John Crow Mountains, 350 m. altitude (*Britton 3992*, March, 1909, type; *3940; 4146; Harris & Britton, 10,680*, *10,724*).

Guettarda constricta sp. nov.

A tree about 7 m. high, the twigs terete. Leaves broadly ovate; blades 17 cm. long or less, about two thirds as wide as long, rather firm in texture, glabrous and bright green above or puberulent on the veins, pale green or whitish and densely puberulent beneath, short-acuminate at the apex, obtuse or subtruncate and sometimes strongly inequilateral at the base, with 8 or 9 pairs of veins on each side of the prominent midvein; petioles stout, puberulent, 6 cm. long or less; peduncles axillary, somewhat angled, puberulent, as long as the petioles or longer; cymes several-flowered; fruit sessile, oval, finely puberulent, 10–12 mm. long, 8 or 9 mm. thick, obtuse at the apex, narrowed at the unequal base, distinctly constricted at the middle.

Wooded hillside, Grove Place, Manchester (*Britton 3769*, September, 1908). The fruit of *G. argentea* is globular.

Psychotria subcordata sp. nov.

A slender tree, 5 m. tall, the twigs and leaves glabrous. Leaves lanceolate to oblong-lanceolate, thin in texture, 7–10 cm. long, 2.5–3.5 cm. wide, sessile, subcordate at the base, acuminate at the apex, dark green above, paler beneath, the midvein rather prominent on both sides, the veins about 10 on each side of the midvein, diverging from it nearly at right angles, curving upward and united 2 or 3 mm. from the margins; stipules apparently distinct, deciduous; cyme sessile, 3-rayed, the rays slender, glabrous, 2.5–3 cm. long, the 2 or 3 raylets 1–1.5 cm. long; fruiting pedicels 2–5 mm. long; fruit globose-oblong, red, nearly 1 cm. long; pyrenae oblong, 8 mm. long, 4 mm. wide, strongly 3-crested longitudinally, with two shallow grooves on the nearly flat commissural side.

Woodlands, eastern slopes of the John Crow Mountains at 520 m. altitude (*Britton 4144*). Related to the Cuban *P. auriculata* C. Wright.

Lobelia grandifolia sp. nov.

Stem stout, somewhat pubescent, about 9 dm. high. Leaves flaccid, large, about 3 dm. long, 10–12 cm. wide, abruptly acuminate at the apex, cuneate at the base, crenulate all around, glabrous and dull green above, rather bright green beneath and pubescent on the veins, the broad flat midvein prominent, the numerous lateral veins arching upward; peduncles stout, pubescent, about 1.5 dm. long; raceme densely many-flowered, 1–1.5 dm. long; bracts linear-lanceolate, acuminate, glandular-serrate, nearly as long as the pedicels; pedicels about 2 cm. long; hypanthium campanulate, glabrous, 1 cm. long; sepals linear-lanceolate, glandular-serrate, 12–15 mm. long, 2 mm. wide; corolla yellowish white, greenish yellow, or brownish, glabrous, strongly curved, about 2.5 cm. long; andrœcium stout, pubescent, 1.5–2 cm. long; anthers 9 mm. long, loosely pubescent, two of them bearded at the tip.

Woodlands, eastern slopes of the John Crow Mountains at about 400 meters elevation (*Britton 4194*, type; *4197*; *Harris & Britton 10,725*). Related to *L. Fawcettii* Urban, in which the leaf-blade is decurrent on the petiole nearly or quite to the base, the sepals narrower and longer, the foliage glabrous or very nearly so.

Bidens Shrevei sp. nov.

Glabrous; stems woody, diffusely branched, reclining or straggling, 3–6 dm. long, the twigs striate. Leaves simple, ovate to lanceolate, 5–10 cm. long, acuminate at the apex, obtuse or subtruncate at the base, sharply serrulate, the slender petioles one third to one half as long as the blades, the finely reticulate venation much darker in color than the parenchyma; heads several or numerous; peduncles 6 cm. long or less; involucre oblong-cylindric, about 1 cm. high, its bracts linear, spreading at anthesis, acutish and puberulent at the apex; rays oval to oblong, bluntish or emarginate, 1.5–2 cm. long, strongly veined; disk-corollas tubular-cylindric, narrowed below, 7–10 mm. long, with acute triangular-ovate teeth; anthers and style-branches slightly exserted; achenes linear, 12–16 mm. long, about 1 mm. thick, sparingly pubescent on the angles, the two yellowish awns 3–5 mm. long, downwardly barbed.

Banks at higher altitudes in the Blue Mountains; type collected by Forrest Shreve at Cinchona, November, 1905.

Chaenocephalus propinquus sp. nov.

A shrub, 2 m. high. Leaves firm in texture, oblanceolate, 5–9 cm. long, acute at the apex, cuneately tapering from above the middle to a sessile entire base, sharply and rather coarsely dentate above the middle, smooth on both sides or minutely scabrate-puberulent beneath, the pinnate venation not very prominent; inflorescence corymbose, 5–8 cm. broad; peduncles appressed-pubescent, 2–4 cm. long, nearly erect, or narrowly ascending; heads numerous, turbinate-campanulate, 6–7 mm. high; involucral bracts pubescent, the outer narrowly oblong to lanceolate, obtuse, 5.5 mm. long, the inner broadly oblanceolate, sharply acute, 5 mm. long, 2 mm. wide; corolla 3.5 mm. long, nearly cylindric above the narrowed base, its lobes triangular-ovate, acute; pappus-bristles about one half as long as the corolla; achene cuneate-oblanceolate, 4 mm. long, 1.5 mm. wide at the top, scabrous-pubescent, the wings nearly 1 mm. wide above.

In rocky soil, Lover's Leap, Yardley Chase, Santa Cruz Mountains, at 530 meters altitude (*Britton 1144*, Sept. 4, 1907; type; *Harris 9672*). Nearly related to *C. venosus* Urban, from wet woodlands on the summit of John Crow Peak, at 2000 meters altitude. (See Urban, Symb. Ant. **5**: 526.)

15. THE GENUS BADIERA DC.

BADIERA DC. Prodr. **1**: 334. 1824

Type species: *Badiera Penaea* (L.) DC.

Leaves obovate to oblong, 1–4 cm. long, obtuse or emarginate.
    Leaves obovate.
        Pubescent; leaves 2–2.5 cm. long, papillose-scabrous. 1. *B. Penaea.*

Puberulent, leaves 1.5 cm. long or less. 2. *B. virgata.*
Leaves oblong. 3. *B. oblongata.*
Leaves ovate, oval or ovate-lanceolate, 2.5–9 cm. long.
Leaves bluntly acuminate, or bluntly acute at the apex.
Leaves 2–3 times as long as wide. 4. *B. diversifolia.*
Leaves less than twice as long as wide. 5. *B. cubensis.*
Leaves rounded or emarginate at the apex. 6. *B. montana.*
Unknown to me, except from description. 7. *B. Berteriana.*

1. BADIERA PENAEA (L.) DC. Prodr. **1**: 335. 1824

Polygala Penaea L. Sp. Pl. 703. 1753.

Polygala domingensis Jacq. Stirp. Am. ed. min. 252. 1788.

Badiera domingensis DC. Prodr. **1**: 335. 1824.

Mountains of Haiti and Santo Domingo. This plant is represented in the herbarium of the New York Botanical Garden by the following specimens: "In montibus, Hispaniola (Jacquemont); Sierra del Palo Quemado, Santo Domingo, at 500 meters (*Eggers 1897*); pineland, Marmelade, Haiti, at 900 to 1100 meters (*Nash 719; Nash & Taylor 1312*).

Professor Chodat ignores *Badiera Penaea* in his monograph, and describes *Eggers no. 1897* as *Polygala domingensis*, not recognizing the genus *Badiera*. Mr. Nash's *no. 719*, which is in young fruit, so closely resembles the original figure of *Polygala Penaea* L. (Plumier, ed. Burmann, *pl. 214. f. 1*) that it appears to me the two supposed species must be one; the character cited by De Candolle (Prodr. **1**: 335) of flowers solitary in *B. Penaea* and flowers racemose in *B. domingensis* is doubtful; the Plumier figure shows the plant in fruit, and in this as in other species of the genus often only one flower of the cluster produces fruit.

2. **Badiera virgata** sp. nov.

A shrub or small tree up to 4 meters high, the branches nearly erect, densely leafy, the twigs finely puberulent. Leaves obovate, or obovate-oblanceolate, rigid, 10 mm. long or less, 4–8 mm. wide, puberulent or minutely papillose-puberulent, or becoming nearly or quite glabrous when old, rounded at the apex, or some of them slightly emarginate, narrowed at the base, the petioles pubescent, 1–1.5 mm. long, the midvein slightly elevated beneath, the lateral venation wholly obscure; flowers several in the axillary clusters or solitary, yellow-green, 2 mm. long; fruiting pedicels 1.5 mm. long; fruit 5 mm. long, the lobes narrowly winged (only imperfect ones with one lobe developed seen).

Thickets in dry soil, Oriente, Camagüey, and Santa Clara, Cuba. (Type, *Britton 2086*, from United States Naval Station, Guantanamo Bay, March 17–30, 1909.)

3. BADIERA OBLONGATA N. L. Britton, Bull. N. Y. Bot. Gard. 5: 314. 1907

DISTRIBUTION: Bahama Islands: Andros, New Providence, Cat Island, Acklin's Island, Crooked Island, Watling's Island, Caicos Islands; Cayo Sabinal and mainland of Camagüey, Cuba (*Shafer 878 1085, 977*; also collected in Cuba by Wright, *no. 115* in part).

The Cuban specimens here referred have leaves mostly more obtuse at the base than those of the typical Bahamian plant, but a specimen from Andros Island (*Small & Carter 8681*) seems to be identical with them.

A plant from the palm barren at Santa Clara, Cuba (*Britton & Wilson 6066*), has shorter emarginate leaves 12–20 mm. long, with the midvein deeply impressed above; it is tentatively referred to this species.

4. BADIERA DIVERSIFOLIA (L.) DC. Prodr. 1: 334. 1824

Polygala diversifolia L. Sp. Pl. 703. 1753.

Polygala jamaicensis Chodat, Mém. Soc. Phys. Genève **31**^{2}: 11. 1893.

Jamaica, in hillside thickets and woodlands in relatively dry districts from sea level up to 1100 meters elevation.

5. **Badiera cubensis** sp. nov.

Polygala diversifolia Chodat, Mém. Soc. Phys. Genève **31**^{2}: 10. 1893. Not L.

Leaves ovate to elliptic, 2.5–6 cm. long, 1.5–3.5 cm. wide, bluntly acuminate or acute at the apex, cuneate-narrowed or acute at the base; fruit 7.5–8.5 mm. long, 10 mm. wide, lobed to about one third, the lobes rounded.

Cuban woodlands; type, *Wright, no. 1913* from "La loma pelada, Dec. 27," in herb. N. Y. Bot. Gard.; also collected by Wright at "La Sabanilla" and distributed under this same number; Wright's *no. 3496* belongs to this species, and also part of his *115*, collected in eastern Cuba.

Professor Chodat indicates this Cuban species as occurring also in Jamaica, but this I take to be an error.

6. **Badiera montana** sp. nov.

A shrub, 3 m. high, the twigs densely puberulent. Leaves broadly oval, 4–5 cm. long, 2.5–3.5 cm. wide, firm in texture, quite densely puberulent when unfolding and sparingly puberulent when mature, rounded or slightly emarginate at the apex, acutish at the base, dull dark green, the midvein slightly impressed in the upper surface, elevated on the underside, the lateral veins few, slender, the rather stout puberulent petioles 2–3 mm. long; inflorescence several-flowered; bracts ovate, acute, pubescent, about 0.5 mm. long; fruiting pedicels pubescent, 1.5–2 mm. long; stipe of the fruit 1 mm. long; fruit 8–10 mm. long, 10–12 mm. wide at the top, puberulent, lobed to about one fifth, the lobes rounded-truncate.

Rocky wooded hill, Arroyo Grande, Trinidad Mountains, Cuba, at about 700 meters altitude (*Britton & Wilson 5461*, March 11, 12, 1910).

Differs from *B. cubensis* by its obtuse leaves, larger and longer fruit.

7. BADIERA BERTERIANA Spreng. Syst. **3**: 172. 1826

Described as with oblong-lanceolate obtuse leaves and recorded as from Hispaniola. Professor Chodat does not refer to this species in his monograph; it was collected by Bertero and called by him *Polygala domingensis*, but Sprengel's description indicates that it is not *Polygala domingensis* of Jacquin, here referred to *Badiera Penaea* (L.) DC.

EXCLUDED SPECIES.

Badiera (?) *acuminata* (Willd.) DC. Prodr. **1**: 335 is POLYGALA ACUMINATA Willd. Sp. Pl. **3**: 887, native of Peru and Chile. Professor Chodat describes it as new in his monograph (p. 46), but the name dates from at least the year 1803.

Badiera (?) *divaricata* DC. Prodr. **1**: 335, from Para, South America (presumably Brazil), was not taken up by Mr. A. W. Bennett in the Flora Brasiliensis.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

CONTRIBUTIONS FROM THE NEW YORK BOTANICAL GARDEN—No. 136

NOTES ON ROSACEAE—III

By PER AXEL RYDBERG

NEW YORK
1910

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL CLUB 37: 375-386. 29 Jl 1910

[From the BULLETIN OF THE TORREY BOTANICAL CLUB, 37: 375–386. 1910.]

Notes on Rosaceae — III

PER AXEL RYDBERG

POTENTILLA

If we were trying to trace the origin of the name *Potentilla*, we should probably find that the name belonged to *Potentilla Anserina* L., or *Argentina Anserina* of the North American Flora. There is no doubt but that very species was the plant usually referred to by the name *Potentilla* among the pre-Linnaean botanists, although other species, as for instance *P. reptans* L., sometimes were meant. As our nomenclature begins with Linnaeus, it concerns us very little, however, what his predecessors named plants. The question that most concerns us is, What application did Linnaeus make of the name *Potentilla?* We know that Linnaeus often adopted names from earlier authors and used them in an entirely different meaning.

As stated before, our nomenclature begins with Linnaeus, and we have agreed to adopt the Species Plantarum of 1753 as the starting point of generic as well as of specific names. As the Species Plantarum does not give any characterization of the genera, and as there are found only a few exceptional cases in which types are assigned, it is necessary to turn to other works of Linnaeus, in order to find his real conception of a certain genus at that time. The best book for this purpose is the fifth edition of his Genera Plantarum, published in the following year. In this we find on page 219 that the genus no. 559, *Potentilla*, was not adopted from anybody else. In other words, whatever the origin of the name *Potentilla* might have been, the concept of the genus originated with Linnaeus himself.* He based it on *Quinquefolium* Tourn. and *Pentaphylloides* Tourn. As *Quinquefolium* is the first of these two synonyms and the only one accompanied by an illustration,† also cited by Linnaeus, we can not help but regard the

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*Linnaeus had the same concept even before the publication of the Species Plantarum, for his genus *Potentilla* remained unchanged in his Genera Plantarum from the first edition to the seventeenth, the last one printed during his lifetime.

†Tourn. Inst. *pl. 153*.

type of *Quinquefolium* Tourn. the type of *Potentilla* L. The plant figured by Tournefort is *Potentilla reptans* L. Tournefort had adopted the name *Quinquefolium* from Caspar Bauhin.* The latter referred directly to the *Pentaphyllon* (πενταφυλλον) of Dioscorides and Theophrastus and Pliny's *Quinquefolium*, all evidently the official plant *Potentilla reptans*. The plate in Dioscorides (Codex Vindobonensis, of which there is a photographic facsimile copy in the library of the New York Botanical Garden) may very well represent *P. reptans*, or at least a species of *Potentilla* with digitately 5-foliolate leaves, 5 petals, and decumbent stem, rooting at the nodes.

A few botanists are inclined to regard the first species mentioned as the type of the genus. The first species of *Potentilla* is *P. fruticosa* L., but this was not a part of Tournefort's *Quinquefolium*. The first Tournefortian species of that genus, cited by Linnaeus, is *P. recta*, and the first Linnaean species given in Tournefort's Institutiones, is *P. alba;* but neither of these agrees with Tournefort's plate, nor can they be traced back to the old Greek and Latin writers, from whom Tournefort adopted the name *Quinquefolium*. There is therefore no species which can dispute the right of *P. reptans* as being regarded as the type of *Potentilla*, except *P. Anserina*, and the latter can do so only if we admit a pre-Linnaean starting point of our nomenclature.

The type of *Tormentilla* L.† is *T. erecta* L., or *Potentilla Tormentilla*, a 4-merous species of the same group as *P. reptans*.

The type of *Quinquefolia* (Tourn.) Adans.‡ and of *Pentaphyllum* Gaertn.,§ is of course also *P. reptans*. The proposing of another genus *Callionia* Greene‖ was, of course, altogether superfluous, for its type, *Potentilla canadensis* L., is so closely related to *P. reptans* that no scientist would seriously think of placing them in different genera. In proposing *Callionia*, the author says: "If *Argentina* be separated from *Potentilla*, it is by habit and inflorescence alone and from this there seems to follow necessarily the conceding of equal rank to what I shall call *Callionia*."

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*Pinax 325.

†Sp. Pl. 500. 1753.

‡Fam. Pl. 2: 295. 1763.

§Fruct. 1: 349. 1788.

‖Leaflets 1: 238. 1906.

Even if there were no structural differences in the flowers of *Argentina* and *Potentilla* (which, however, exist), there are not even any essential habitual differences between *P. canadensis*, *P. simplex*, and *P. pumila* on one hand, and *P. reptans*, *P. procumbens*, and *P. Tormentilla* on the other.

Dactylophyllum Spenner* was a merging of *Potentilla*, *Fragaria*, *Sibbaldia*, etc., without any real type.

The types of *Chamaephyton*, *Dynamidium*, and *Hypargyreum* Fourr.† are *Potentilla supina* L., *P. verna* L., and *P. argentea* L., respectively. Fourrier also proposed several other genera, of which *Drymocallis* was adopted by me for *P. rupestris*, *P. glandulosa*, and their allies. The rest of Fourrier's genera are not represented by American species. Whether they should be regarded as distinct genera or not, can be decided only by further study, and was out of the scope of the North American Flora.

The monotype of *Potentillopsis* Opiz is *Potentilla pentandra* Engelm.

Tridophyllum Necker‡ has no type. It was based on the trifoliolate species of *Potentilla* L., of what book of Linnaeus Necker does not state under *Tridophyllum;* but on page 94 we find that he had in mind the 14th edition of the Systema. This mattered little, however, in this case, because this division of *Potentilla* remained unchanged from the first edition of the Species Plantarum to the 14th edition of the Systema, the first and the last of the works of Linnaeus that Necker possibly could have had. The group contained *P. monspeliensis*, *P. norvegica*, *P. nivea*, *P. grandiflora*, and *P. subacaulis*. Only the two first belong to *Tridophyllum*, as modified by Dr. Greene.§ He states: "Among all segregated genera that have been proposed, not one is better entitled to the rank of a genus than Necker's *Tridophyllum*. As its name indicates, it is founded upon species of Linnaean *Potentilla* having trifoliate leaves. But this mark of the foliage is not one which is considered essential. He makes the generic rank of the group to rest on the very small ovaries, greatly reduced styles and minute naked achenes. The so-called Potentillas that evince these characters have other marks more obvious. Their roots are annual, or now and then of biennial duration. All other plants that ever were referred to *Potentilla* are perennial, and very many suffrutescent." So far, Dr. Greene. Let us see of what value these characters are. *Potentilla nivea*, *P. grandiflora*, and *P. subacaulis*, also trifoliolate species of the Linnaean *Potentilla*, and hence part of *Tridophyllum* Necker, do not fulfill this characterization. Some may claim that they did not constitute a part of Necker's genus, but why not? Necker placed the pinnate-leaved species in *Potentilla*, the trifoliolate ones in *Tridophyllum*, and the digitate-leaved ones with more than three leaflets he transferred to *Tormentilla*. In a note under *Tormentilla* he states that 5 species of *Potentilla* are to be referred to *Tridophyllum;* hence the five given above, of which *P. subacaulis* has very long styles and the other two have rather large achenes. They are all three perennials.

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*Fl. Frib. 1084. 1829.

†Ann. Soc. Linn. Lyon II. 16: 371. 1868.

‡Elem. 2: 93. 1790.

§Leaflets 1: 188. 1905.

But is *Tridophyllum* as modified by Greene a well-defined genus? *Potentilla intermedia* and *P. heterosepala* have both the very short styles and numerous small achenes, and are both included in the SUPINAE group by Dr. Wolf, the world-authority on *Potentilla;* but they are both perennials. The former is very close in habit to *P. monspeliensis*, which occasionally is a short-lived perennial. *Potentilla Newberryi* has all the character of that group, but the style is long. The short style, often glandular at the base, and the numerous small achenes, characteristic of the SUPINAE group, are found in many other Potentillas, especially of the MULTIFIDAE group. These characters are worth little as generic characters.

While vol. 25, part 4, of the North American Flora was going through the press, we received at the New York Botanical Garden the excellent monograph of the genus *Potentilla* by Dr. Theodor Wolf.* If this valuable work had reached us a little earlier, some changes and corrections might have been made in my monograph, and quite a number of synonyms could have been added. The monographing of the whole genus, for the whole world, is a stupendous undertaking. Dr. Wolf's work is one of the most elaborate, conscientious, and critical ever published. It is a large quarto of 716 pages and 20 plates, good paper and good large print. The descriptions in Latin are excellent and complete. To these are added elaborate discussions and notes in German. The synonymy is practically complete, and the citations have nothing of the vagueness so characteristic of many so-called monographs.

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*Bibliotheca Botanica, Heft 71.

As one should expect, a comparison of Dr. Wolf's monograph and my treatment of the genus in the North American Flora discloses many differences; but most of these result from our different views. Dr. Wolf is exceedingly conservative both as to genera and species, and the present writer has the reputation of being exceedingly "radical." Dr. Wolf believes in large genera and broad species, and admits numerous varieties and forms; while the writer believes in small genera and narrowly limited species. If the diversity of two plant forms is of any value at all, the writer admits them as distinct species; if the variation is a trifling one, it is simply ignored. In this way the old rank of variety has been disposed of. Of course, also, many of the differences arise from the fact that Dr. Wolf had no or insufficient material of American plants and had to rely upon the printed descriptions alone in many cases.

While Dr. Greene seems to go too far in splitting up the genus, Dr. Wolf is in my opinion too conservative. He has left *Potentilla* with about the same limitation as Lehmann had in 1856, only that he has merged even *Duchesnea* in *Potentilla*. I can not understand why he did not treat *Sibbaldia* in the same way. This genus is really much more related to *Potentilla* than *Drymocallis* and *Dasiphora* are. The only distinctions given by Dr. Wolf are: "Stamens 5 (very seldom 10); carpels 5–15 (the few Potentillas with only 5 stamens have always numerous carpels)." But there are several Potentillas that have few carpels although they have 10–20 stamens. The distinctions are therefore not well drawn. Of course the position of the style, which I have used as a generically distinctive character, will place it outside of *Potentilla* proper and in the group with *Dasiphora*. Dr. Wolf, however, does not regard this as a generic character and therefore, if consistent, he should have merged *Sibbaldia* into *Potentilla*.

Dr. Wolf has divided the genus *Potentilla* into 2 sections and 6 subsections. These subsections are based on the differentiation of the styles. It is practically the same character as I used in distinguishing the genera, only that I placed more importance on the position and Dr. Wolf on the form of the style. I also took the stamens into consideration, which Dr. Wolf only incidentally mentions. Dr. Wolf's RHOPALOSTYLAE correspond to my genus *Dasiphora*. His NEMATOSTYLAE correspond to *Sibbaldiopsis* and *Comarum*, together with several groups not American and therefore not treated by me. These two subsections constitute his section POTENTILLAE TRICHOCARPAE. It is evident that *Comarum* (*Potentilla palustris* of his monograph) should not be counted in this section, as the carpels are perfectly naked. He associates *P. palustris*, a herbaceous plant with creeping rootstock and glabrous achenes, with *P. Salesowiana*, a shrub with hairy achenes. While the latter is in its right position in the system, the former is not. I shall discuss this further under the genus *Comarum*. To Dr. Wolf's POTENTILLAE GYMNOCARPAE belong the rest of the subsections. CLOSTEROSTYLAE correspond to the genus *Drymocallis* and LEPTOSTYLAE to *Argentina*. The subsections CONOSTYLAE and GOMPHOSTYLAE show so many intergradations, a fact admitted by Dr. Wolf, that there is no ground, in my opinion, for keeping them apart. They constitute what I have called *Potentilla*. In the main points Dr. Wolf and myself agree, the only difference being that what he calls subsections, I call genera. I can not help, however, but accuse Dr. Wolf of inconsistency, for *Sibbaldia*, *Fragaria*, *Horkelia*, *Comarella*, and *Stellariopsis*, all admitted by Dr. Wolf, are none of them better genera than these subsections.

Now let us take up the different groups of *Potentilla* in the order they are in the North American Flora.

TORMENTILLAE

This contains six species, of which two, *Potentilla reptans* and *P. procumbens*, are introduced. Dr. Wolf admits only one North American species, regarding *P. pumila* and *P. simplex* as varieties of *P. canadensis*. *Potentilla caroliniana* was evidently unknown to him. Regarding *P. pumila*, he states that I regarded it in 1898 as a distinct species but withdrew the rank in 1899 (refering to the Bulletin of the Torrey Botanical Club for that year, page 25), after Clute had reported *P. canadensis* and *P. pumila* as growing together on the sand barrens of Long Island and were "connected through intermediate forms." The page referred to contains the proceedings of the Club. I had nothing to do with it and my name was not even mentioned. Clute's report on the sand barren flora contains a statement very opposite to what Dr. Wolf gives, viz.: "*Potentilla pumila* and *P. canadensis* growing together without intermediate forms." Robinson and Fernald, who give *Potentilla* a very conservative treatment in Gray's New Manual, keep them distinct, although they regard *P. simplex* a variety of *P. canadensis*. I for some time thought that an additional species could be distinguished from *P. canadensis*, viz., the plant common in the lower Mississippi Valley. This has much thicker and more shining leaves and usually longer bractlets than the common *P. canadensis* of the North Atlantic States, but these characters were found to be too unstable and the plant grades so into the typical form that the idea was given up.

HETEROSEPALAE

This group contains only one species from Mexico and Central America. Dr. Wolf refers it to the SUPINAE group, perhaps rightly so.

SUPINAE

In the North American Flora 12 species are admitted. Of these, *Potentilla rivalis*, *P. millegrana*, *P. biennis*, *P. michoacana* and *P. pentandra* are regarded by Dr. Wolf as distinct species; and *P. paradoxa* and *P. monspeliensis* are regarded as varieties of the European *P. supina* and *P. norvegica* respectively. *P. Nicolletii* is made a mere form (f. *decumbens*) of *P. supina paradoxa*. A comparison between this treatment and the one in Gray's New Manual is rather interesting. In that publication *P. Nicolletii* is regarded as a good species, while *P. millegrana* and *P. pentandra* are made varieties of *P. rivalis*. Whatever may be said, *Potentilla Nicolletii* is a rather weak species, while *P. pentandra* is one of the most distinct in the group. Opiz even based a new genus on the same. It is also interesting to know that the specimen which Sheldon had most in mind when he raised *P. Nicolletii* to specific rank and which he distributed under that name, was not a specimen of *P. supina Nicolletii* S. Watson or *P. Nicolletii* of my monograph, but of *P. millegrana*.

Dr. Wolf claims that *Potentilla labradorica* Lehm. is but a depauperate form of *P. norvegica hirsuta* (*i. e.*, of *P. monspeliensis*). Lehmann's description, however, suggests another plant, differing from that species not only in the almost complete lack of pubescence but also in the obtuse and oval instead of lanceolate bractlets, the broader obcordate petals and smooth instead of rugulose achenes. It is a subarctic plant and evidently the same as *P. flexuosa* Raf., an older name.

The remaining species, *Potentilla flavovirens*, *P. Kelseyi*, and *P. leurocarpa* were described as new in the North American Flora, and were evidently unknown to Dr. Wolf. They are all three very local. *P. Kelseyi* may be a hybrid between *P. biennis* and *P. monspeliensis*.

ARENICOLAE

This contains only one species, *P. Newberryi*, which Dr. Wolf includes in the preceding group.

ARGENTEAE

This group is a rather artificial one and if I had had Dr. Wolf's monograph at hand when the manuscript was prepared I should have made other arrangements. The group consists of four introduced species. Of these Dr. Wolf has placed *Potentilla intermedia* in the SUPINAE group on account of its short style. It is evidently related to that group and often closely resembles *P. norvegica* but is an evident perennial. Most specimens of this species collected in this country belong to a form with the leaflets more deeply dissected and inclined to be more or less pedately instead of strictly palmately arranged. This form was described as *P. digitato-flabellata*, from seed said to have come from America. Perhaps it is a native and distinct from the European species. I have never seen it growing. It would be worth while for botanists who have the opportunity to see it in the field to give it a thorough study. *P. argentea* is rather common and is found in this country in many forms. I did not take the trouble to try to identify these with the numerous described varieties.

RECTAE

This group contains two closely related introduced species. Dr. Wolf regards them as varieties of one.

HEPTAPHYLLAE

This group consists of a single species, which Dr. Wolf includes in his Grex *Ranunculoides*, a mixture of plants of diverse habits, from the groups *Heptaphyllae*, *Aureae*, *Subviscosae*, *Subcoriaceae* and *Nuttallianae*. In my monograph I had followed S. Watson in calling the species *Potentilla heptaphylla* Mill. It is not closely related to that species. For some years I had known my mistake but did not correct it until I did so in the North American Flora. Dr. Wolf had also noticed it and proposed a new name for the species. As his name is a few months older, the species has to bear the following name and synonymy.

POTENTILLA PALMERI Th. Wolf. Bibl. Bot. **16:** 513. 1908

P. heptaphylla S. Wats. Proc. Am. Acad. **17:** 353; hyponym. 1882.—Rydb. Mem. Dep. Bot. Columbia Univ. **2:** 62. 1898. Not *P. heptaphylla* Mill. 1768.

P. leptophylla Rydb. N. Am. Fl. **22:** 310. N 1908.

NUTTALLIANAE

Coulter and Nelson, in the New Manual of Botany of the Central Rocky Mountains, have reduced *Potentilla brunnescens* Rydb. to a doubtful synonym of *P. pectinisecta*, to which it has indeed very little relationship. Its nearest relative is without doubt *P. Nuttallii*. Dr. Wolf, who is even more conservative as a rule than the authors of the New Manual, admits it as a distinct species, but changes the name to *P. brunescens*, for what reason I do not know. As far as I know, both *brunneus* and *brunnescens* are usually spelled with two *n*'s.

Potentilla Townsendii is placed in the *Ranunculoides* by Dr. Wolf and placed between *P. fragiformis* and *P. Palmeri;* but it is not related at all to either of the two. It has no close relative as far as I know, but must be placed in the group in which I placed it in the North American Flora, unless it is to be regarded as a group by itself.

The only species in North America which resembles it in leaf-form is *P. angustata* Rydberg, proposed as new in the North American Flora, but this is much more closely related to *P. Nuttallii*. It is known only from the type collection.

The new species proposed in this group are *Potentilla angustata*, *P. grosse-serrata*, *P. rectiformis*, *P. amadorensis*, *P. macropetala*, *P. Parishii*, *P. dascia*, and *P. lasia*.

Potentilla grosse-serrata was based partly on material referred by me in my monograph to *P. Blaschkeana*. As treated there, the latter species was composed of a mixture of *P. grosse-serrata*, *P. glomerata* A. Nels., *P. dascia* Rydb., and the true *P. Blaschkeana* Lehm. I shall give a further discussion under the latter species. Some of the more typical specimens of *P. grosse-serrata* are here given:

CALIFORNIA: Donner Lake, 1865, *Torrey 121* (*a*); *Bridges 98;* between Igera and Weed, 1905, *Heller 8092;* (Geological Survey 1860–7) *Rattan 234*.

NEVADA: Ruby Valley, 1868, *S. Watson 339*.

WASHINGTON: *Vasey 322*.

When preparing the manuscript of my original monograph, I had two specimens, rather fragmentary, of *Potentilla rectiformis*. One was doubtfully and hesitatingly referred to *P. recta*, the other to *P. pectinisecta*. The following specimens belong here:

WASHINGTON: Pullman, 1896, *Elmer 29*, "Kuskuske and Fort Vancouver," *Wilkes*.

MONTANA: Spanish Basin, 1897, *Rydberg & Bessey 4379*.

Potentilla amadorensis is known only from the type locality.

Potentilla macropetala resembles much in habit *P. glaucophylla* but has much larger flowers. The stem is also much stouter and and the plant much coarser, wherefore it was placed here rather than in the MACULATAE. To this species I refer the following specimens:

CALIFORNIA: Laguna, 1894, *Schoenfeldt 3576;* 1866, *Bolander 5036;* San Diego, *Palmer*.

OREGON: Tillamook, 1894, *Lloyd*.

Potentilla Parishii is closely related to *P. Hallii* and the first specimens seen were referred to that species by me a few years ago, but it differs in the fine appressed instead of spreading and coarser pubescence of the stem. The following specimens are referred here:

CALIFORNIA: Descanso, 1897, *Parish 4523;* Cuyamaca Lake, 1903, *Abrams 3871;* San Jacinto Mountains, *Hall 2296;* Fresno County, 1900, *Hall & Chandler 182*, in part; Laguna Mountains, San Diego County, 1904, *Brandegee.*

Some of the specimens belonging to *Potentilla dascia* were included in *P. Blaschkeana* in my monograph. Later I referred them to *P. glomerata* A. Nelson. It is evidently related to the latter, but differs in the open inflorescence and the pubescence, which is much coarser and not at all tomentose, but slightly puberulent as well as hirsute on the lower surface of the leaves. I refer here:

WASHINGTON: 1889, *Vasey 320;* Ellensburg, 1897, *Piper 2736;* Wilson Creek, 1892, *Lake & Hull 518*; Wilson Creek, 1893. *Sandberg & Leiberg 315.*

OREGON: Dalles, 1869, *Harford & Dunn 1144.*

MONTANA: Bozeman, 1892, *Mrs. Alderson*; 1874, *Coues.*

Potentilla lasia is related to *P. Hallii* but is characterized by the few and large teeth of the leaves and the oblong-lanceolate instead of narrowly linear-lanceolate bractlets. To it are referred:

CALIFORNIA: Schwartout Cañon, San Antonio Mountains, 1899, *Hall*; Bear Valley, San Bernardino Mountains, 1894, *Parish 3252;* Los Angeles County, 1899.

Dr. Wolf reduces *Potentilla Hallii* to a variety of *P. gracilis*, evidently without having seen a specimen. This is not the only case he has treated in that way, for in about half the cases where species have been described by later authors, he has reduced them to varieties of what seemed to him the nearest species. In habit the plant resembles much more what Dr. Wolf describes under the name *P. pulcherrima*, than *P. gracilis*, but it lacks tomentum on the lower surface of the leaves and therefore should be placed near *P. etomentosa* in the *Nuttallianae* group.

Dr. Wolf admits *Potentilla etomentosa* as a valid species, citing specimens from Wyoming. Not all species so named from Wyoming belong to *P. etomentosa*, for some are *P. jucunda.* The latter he reduces to a variety of *P. diversifolia*, claiming that he can scarcely separate it from the variety *glaucophylla.* This statement he bases on specimens received from me, collected at Chambers Lake, Col. In the Chamber's Lake collection, distributed by the Agricultural College of Colorado and named by me, large specimens of *P. glaucophylla* and rather small ones of *P. jucunda* were mixed. I did not notice this fact when the specimens were sent out and Dr. Wolf may have received specimens of the former instead of the latter.

In the New Manual of the Central Rocky Mountains the author of the name *Potentilla jucunda* has reduced it to a synonym of *P. Nuttallii*, but it differs in the total lack of the glandular pruinosity characteristic of that species, in the thinner leaflets, and less prominent veins.

As an appendage of this group, I added two Mexican species, *P. oaxacana* Rydb. and *P. Goldmani* Painter, with thicker leaves and but 5 leaflets to the basal leaves. They are known only from the type localities.

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STUDIES ON THE ROCKY MOUNTAIN FLORA—XXIII

By PER AXEL RYDBERG

NEW YORK
1910

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL CLUB **37**: 443–471. 5 10 1910

[From the Bulletin of the Torrey Botanical Club, 37: 443–471. 1910.]

Studies on the Rocky Mountain flora — XXIII

Per Axel Rydberg

Gaillardia Mearnsii sp. nov.

Annual; stem 1–3 dm. high, leafy only towards the base, finely pubescent; basal leaves oblanceolate or spatulate, petioled, 5–10 cm. long, puberulent, entire or round-lobed; upper leaves similar or sometimes pinnatifid with rounded lobes; peduncles 1–2 dm. high; involucres about 2 cm. broad; bracts lanceolate, acute, grayish-pubescent; disk-corollas purple, their lobes short and rounded, fimbriate; pappus-scales lanceolate, each gradually attenuate into a slender awn equaling the corolla; rays yellow, 10–15 mm. long.

The type sheets were labeled *G. aristata*, which it somewhat resembles in general habit, but the lobes of the disk-corollas are not attenuate. It resembles, however, still more, *G. arizonica* in the annual root, the stem naked above, and the leaf-form, although the leaves are more inclined to be entire; but it differs from that species in the purple disk and the gradually acuminate and long-aristate pappus-scales. On the whole, it is therefore more nearly related to *G. pinnatifida*, although the plant is evidently an annual and the leaves are seldom pinnatifid. When pinnatifid, their lobes are short and rounded.

Arizona: Fort Verde, May 4, 1888, *Mearns 322* (type, in herb. N. Y. Bot. Gard.).

Utah: Sandy bluffs near Green River, June 12, 1900, *Stokes*.

TETRANEURIS

In Coulter & Nelson's New Manual the name *Actinella* Nutt. has been readopted for this genus, apparently in conformity with the Vienna Rules. Nuttall, however, did not intend to propose a new genus *Actinella*, but thought that the *Galardia acaulis* of Pursh belonged to *Actinella* Pers., based on *Actinea* Juss. In reality there is no such thing as *Actinella* Nutt. *Actinella* Pers. is a synonym of *Cephalophora*, to which even DeCandolle thought *Galardia acaulis* belonged.

The way Professor Nelson has handled other persons' species of this genus and his own is very arbitrary. *Actinella simplex* A. Nels., *A. incana* A. Nels., and *A. eradicata* A. Nels. he keeps distinct from *A. acaulis* (Pursh) Nutt. Both *Actinella depressa* A. Gray and *Tetraneuris brevifolia* Greene he makes synonyms of his own *Actinella acaulis caespitosa*, and *Tetraneuris glabra* Greene and *T. glabriuscula* Rydb. of his own *Actinella epunctata*. He unites *T. linearis* Greene (Nutt.) and *T. angustifolia* Rydb.; *T. fastigiata* Greene and *T. stenophylla* Rydb.; and lumps under *Actinella leptoclada* A. Gray not only *Tetraneuris mancosensis* A. Nels. and *T. intermedia* Greene but also *T. Crandallii* Rydb., *T. arizonica* Greene, and *T. pilosa* Greene (?).

My studies of the genus have given me quite different results. *Galardia acaulis* Pursh was collected by Bradbury in "Upper Louisiana." Any one who knows a little about Bradbury's travels knows that this meant along the Missouri River, somewhere between St. Louis, Mo., and Fort Mandan, N. D. Further, the type locality must have been in South Dakota or North Dakota, as no species of *Tetraneuris* is known to grow near the Missouri south thereof. The common plant of the plains and hills of the western part of the Dakotas and Nebraska has densely silky, linear-oblanceolate leaves. It is well represented by my own *nos. 106* and *196*, by *MacDougal 53* from Nebraska, and by *Bolley 404* from Mendora, N. D. It is true that the type of *Tetraneuris incana* A. Nels. (*Elias Nelson 5006*) is slightly more delicate and whiter than these, but *A. Nelson 8265*, determined by the author himself as *T. incana* matches perfectly my *no. 106*. *Actinella* or *Tetraneuris incana* A. Nels. is therefore in my opinion the true *T. acaulis* (Pursh) Greene. It is the only one that has been collected in the neighborhood of the type locality. The only other species that has been collected in the Dakotas or Nebraska is *T. simplex* A. Nels. and that only in the very extreme western portion. The latter does not agree with the description of *Galardia acaulis.*

I have come to the conclusion also that *Tetraneuris eradiata* A. Nels. is but a rayless form of *T. acaulis.* My *no. 106* contains both radiate and rayless specimens. The disk-flowers of *T. eradiata* are said to be "almost orange." They usually turn more or less orange in age in *T. acaulis* and the type of *T. eradiata* is pretty well advanced in age. There are no other distinctive characters either in the description or in the specimens that I can see.

Even *Tetraneuris simplex* is not too good a species and it is very close to *T. acaulis* on one hand and *T. trinervata* Greene on the other. The latter I had reported for Colorado in my Flora of Colorado; but it is wholly ignored by Nelson. As the New Manual includes northern New Mexico, the type locality even of *T. trinervata*, viz., Sandia Mountains, N. M., between Santa Fé and Albuquerque, is within the range.

What Professor Nelson's interpretation of *Actinella acaulis* really is, is hard to tell, for some of the specimens he has distributed under that name and *Tetraneuris acaulis* belong to *T. lanata* and others to *T. acaulis caespitosa* A. Nels. Most of them were distributed before the latter was segregated. Both *E. Nelson 4329*, distributed as *T. acaulis*, and *A. Nelson 4607*, distributed as *T. lanata ?*, match perfectly a part of the type of Nuttall's *Actinella lanata* in the Torrey herbarium. All three are very young.

It is evident that *Actinella acaulis caespitosa* A. Nels. is more closely related to *A. lanata* than to *A. acaulis.* It has the loose pubescence of *A. lanata*, a character best seen in age. I am inclined to think that it is the same as *Tetraneuris brevifolia* Greene, although I have not seen the type of the latter. It should then bear that name, unless it is reduced to a variety of *A. lanata.* The plant was first collected by James in Long's Expedition on James Peak (now Pikes Peak), the type locality of *T. brevifolia.* Torrey* referred this specimen to *Actinea integrifolia* Kunth; but in Torrey and Gray's Flora,† it was referred to *Actinella lanata* with the following remark: "The specimen of

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*Ann. Lyc. N. Y. **2**: 213.

†**2**: 382.

A. integrifolia? Torr. *loc. cit.* is so imperfect that we can not very confidently refer it to the present species; but it certainly is not the same with the foregoing" [*A. Torreyana*].

When preparing the manuscript of the Flora of Colorado, I overlooked the publication of *Tetraneuris epunctata* A. Nels. Otherwise I should not have proposed *T. glabriuscula* to replace the untenable *T. glabra* Greene. I am perfectly willing to reduce the last two to synonymy. This is, however, not the case with *T. angustifolia*. In the key Professor Nelson has a division, "Crowns of the caudex short" in contrast to "Crowns of the caudex fastigiate and elongated, 1–2 dm. high." Under the first division he includes *Actinella linearis*. If he had given *A. angustifolia* instead it would have been correct. The type of *Actinella scaposa linearis* was collected by Riddell in Texas and is preserved in the Torrey herbarium. It has elongated branches of the caudex as have *Tetraneuris fastigiata* and *T. stenophylla*, and differs from them mainly in the fact that the bases of the leaves are scarcely dilated. I think that *Tetraneuris fastigiata* and *T. stenophylla* also are distinct. This is only a matter of difference in opinion as to limitation of species. If they are to be united, they should be included in *T. linearis*, which is just as closely related. *Tetraneuris angustifolia* on the contrary is more distinct and related to *T. Torreyana*, but lacks the hair-tufts at the bases of the leaves.

Tetraneuris mancosensis A. Nels. is a synonym of *Actinella leptoclada* A. Gray. I am now inclined to regard *T. intermedia* Greene also as such, although I kept it distinct in the Flora of Colorado. But I think it goes too far in "lumping," if one tries to include the acaulescent *Tetraneuris Crandallii*, *T. arizonica*, and *T. pilosa* in the leafy-stemmed *T. leptoclada*. Besides the difference in habit the acaulescent species have abruptly aristate pappus-scales, while in *T. leptoclada* the scales taper gradually into the bristle-point. *Tetraneuris Crandallii* in habit closely resembles *T. Torreyana*, but the scape in not villous and the pappus is different. *T. arizonica*, in which I am inclined to include *T. pilosa*, resembles *T. epunctata*, but the leaves are more hairy, more punctate, and have conspicuous hair-tufts at the bases.

It seems as if enough species have been proposed in this genus, but still there is a plant of Montana, Idaho, and Saskatchewan, related to *Tetraneuris acaulis*, though differing in so many respects that it would be inconsistent to include it in that species. I therefore propose it as new:

Tetraneuris septentrionalis sp. nov.

An acaulescent perennial, with a short, thick cespitose-pulvinate caudex; leaves spatulate or oblanceolate, mostly rounded at the apex, 1.5–4 cm. long, 5–8 mm. wide, canescent-tomentose, subvelutinous; scape 5–10 dm. high, rather thick, appressed-tomentose; involucres 6–7 mm. high, 12–15 mm. broad, densely villous; bracts elliptic, rounded at the apex; rays 8–10 mm. long, 5–6 mm. wide, very strongly veined; achenes silky-strigose; pappus scales ovate, abruptly short-aristate.

This is related to *Tetraneuris acaulis* and *T. simplex*, but differs from both in the broader leaves, the looser pubescence, the usually shorter and stouter scape, and short bristle-tips of the pappus scales; from the former of these also in the less silky pubescence and the larger and more strongly veined rays, and from the latter in the dense pubescence.

IDAHO: Palouse Country, June–July, 1892, *G. B. Aiton* (type, in herb. N. Y. Bot. Gard.).

MONTANA: Fort Benton, *John Persall 926*; Livingston, June, 1899, *Tweedy*.

SASKATCHEWAN: Cypress Hills, June 23, 1894, *John Macoun 5078*.

WYOMING: Yellowstone Park, June, 1888, *C. H. Hall*.

Hymenoxys Macounii (Cockerell) Rydb. comb. nov.

Hymenoxys Richardsoni, var. *Macounii* Cockerell, Bull. Torrey Club **31**: 474. 1904.

It is not plain whether Professor Cockerell intended this as a variety of *H. Richardsoni* or of his *H. Richardsoni*, subsp. *pumila*. From the discussion, the latter interpretation seems most probable, but technically it seems to have been made a variety of the species. In habit it is most like *H. pumila*, but it has one character that was overlooked by Professor Cockerell, viz., the outer bracts are much thickened on the back, even subcarinate. This would associate the plant with *H. floribunda* rather than with *H. Richardsoni*. The rays are, however, not so broad or so decidedly cuneate as in that species. The following specimens belong to *H. Macouni*.

SASKATCHEWAN: 1858, *Bourgeau;* Cypress Hills, 1880, *John Macoun*; Medicine Hat, 1894, *John Macoun 5077*; Bare Hills, 1906, *Macoun & Herriot 72840.*

MONTANA: "Northwest Boundary," 1874, *Coues;* Falls of Missouri, 1886, *R. S. Williams 4520;* Midvale, 1903, *Umbach 150;* Manhattan, 1895, *Rydberg 2936.*

Hymenoxys Greenei (Cockerell) Rydb. comb. nov.

Picradenia biennis Greene, Pittonia 3: 272, in part. 1898. Not *Actinella biennis* A. Gray. 1878.

Hymenoxys Lemmoni Greenei Cockerell, Bull. Torrey Club **31**: 479. 1904.

I think this is specifically distinct from *Hymenoxys Lemmoni.* The best character to distinguish the two was not pointed out by Professor Cockerell or by Dr. Greene. The inner bracts in *Palmer 261*, the type number of *H. Greenei*, of which there are five specimens on two sheets in the Columbia University herbarium, are broadly obovate and more or less erose-dentate on the margins, while in all specimens seen of *H. Lemmoni* they are elliptic and entire. *Watson 616*, from Nevada and referred to the subpecies *Greenei*, belongs to *H. Lemmoni.*

DUGALDEA

Professor Nelson included in this genus *Hymenoxys helenioides* Cockerell (*Picradenia helenioides* Rydb.), on what ground I do not know. Both I, who, with Mr. Vreeland, discovered the plant, studied it in the field, and described it, and Professor Cockerell, who has spent so much time on *Hymenoxys*, believed it a good species of that genus. In *Dugaldia Hoopesii* the bracts are in more than two series, distinct, and in age reflexed; in *Hymenoxys helenioides* they are as in the rest of that genus not reflexed, in strictly two series, and those of the outer series are united at the base.

DYSODIA

Nelson in the New Manual has evidently given *Dysodia* Cav. the same limitation as it has in Engler & Prantl's Pflanzenfamilien, *i. e.*, including *Adenophyllum*, *Hymenatherum*, *Aciphyllaea*, *Thymophylla*, and *Lowellia*. If so, the name *Dysodia papposa* (Vent.) Hitch. and *D. aurea* (A. Gray) A. Nels. can be used; but if these genera are to be regarded as distinct or if they are limited as by Gray and by Hemsley, the names are not the correct ones. The monotype of *Dyssodia* Cav. (originally spelled with two *s*'s), is *D. Porophyllum* = *Adenophyllum* Hemsl., which is not congeneric with either of these species according to Hemsley. The only available generic names for the two species of the Rocky Mountain region would be *Boebera* Willd. and *Lowellia* A. Gray, respectively.

ARTEMISIA

The treatment of *Artemisia* in the New Manual of the Central Rocky Mountains is very unsatisfactory. The author has kept up five of his own species and reduced every species proposed by any one else since 1884 and some before that year, either to synonymy or else to a variety of some older species, except *Artemisia saxicola* Rydb., which was a substitute for the North American so-called *A. norvegica*. Now let us see what the facts really are. There are only two species of Professor Nelson's that I am inclined to uphold, viz., *Artemisia aromatica* and *A. nova*. In such a "conservative" work as the New Manual generally is, even these ought to have been reduced to varieties.

It is questionable if *Artemisia aromatica* A. Nels. can be kept specifically distinct from *A. dracunculoides*. The latter is fully as common in the Rockies as is *A. aromatica*, and even one specimen distributed from the University of Wyoming and named *A. aromatica*, viz., *Goodding 602*, is typical *A. dracunculoides*. Also an older specimen, *Nelson 2469*, belongs here.

Artemisia nova A. Nels. was not altogether new when it was described. In fact, several specimens were found in herbaria before that time under the name *Artemisia arbuscula*. If I am not mistaken, it constituted a part of Nuttall's original *A. arbuscula*, although the description fits better the other part, which therefore may be regarded as the type. Dr. Gray* states: "Two forms, passing into each other (both collected by Nuttall, * * *); one with involucres more campanulate, 7–9-flowered; in the other oblong and only 4–5-flowered." The latter is *A. nova* A. Nels.

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*Syn. Fl. 1^2: 374.

The other Nelsonian species have in my opinion no claim to specific rank. Two duplicates of the type of *Artemisia gracilenta* A. Nels., one in the Columbia University herbarium and the other in the New York Botanical Garden collection, are almost identical with the two original specimens of *A. floccosa* Rydb. The only difference is that the segments of the leaves of the former are somewhat narrower. There are also two duplicates of *A. paucicephala* A. Nels., which differs from *A. floccosa* only in the fact that the upper leaves are entire. As Nelson himself unites *A. paucicephala* and *A. gracilenta* and the original *A. floccosa* is intermediate between the two, I see no reason why they should not be reduced to synonyms of *A. floccosa*, which is three years older.

Artemisia subglabra A. Nels., of which there are two duplicates here, is identical with *A. graveolens* Rydberg, three years older. The leaves of even Nelson's own specimens show traces of tomentum on the lower surface. The species is related to *A. discolor*, not to *A. saxicola*, with which Nelson has placed it.

Artemisia natronensis A. Nels. is, according to a duplicate of the type and several specimens distributed from the University of Wyoming, the same as *A. longifolia* Nutt., as that species is understood. The specimens which I referred to *A. natronensis* in my Flora of Colorado do not belong there. They are unusually large-headed *A. diversifolia* or at least closely related to it. I wish to make this correction here.

Now let us take up the species reduced by Professor Nelson. *Artemisia Scouleriana* (Besser) Rydb. and *A. Forwoodii* S. Wats. are reduced to synonyms of *A. canadensis*.

Artemisia canadensis Michx. is a subarctic plant and not found in the Rocky Mountains within the United States. The type came from the shores of the Hudson Bay. It is a low plant with the leaves mostly basal, with narrowly linear divisions, and comparatively few heads nearly as large as those of *A. spithamaea* Pursh (*A. borealis* Auct. Am.) and in a narrow panicle. I have seen specimens from the White Mountains; Vermont; the Gaspé Peninsula, Que.; Keweenaw Point, Mich.; and the Yukon Territory; but from nowhere in our western states. The specimens named *Artemisia canadensis* from there belong to *A. Forwoodii* or *A. Scouleriana*. Whether the latter two should be regarded as distinct is questionable, but they are evidently different from *A. canadensis*, and Besser, regarding them as such, referred them, first to *A. desertorum* and later to *A. commutata*. In the original publication,* Dr. Watson compares *A. Forwoodii* with *A. discolor*, to which it has no close relationship. It is the same as *A. desertorum Hookeriana* Besser.†

Artemisia kansana Britton and *A. stenoloba* Rydb. are given as synonyms of *A. Wrightii*. The description of the last in the New Manual is mostly copied from Dr. Gray, who perhaps included *A. kansana*, but the type, *Wright 1279*, is not the same as *A. kansana* Britton. The plant Professor Nelson had in mind is evidently *A. kansana* and not the true *A. Wrightii*, judging from the key and from the association with *A. coloradensis* Osterhout. The true *Artemisia Wrightii* has an involucre only slightly tomentose and the leaves glabrate above and is very close to *A. Bakeri* Greene, differing mainly in the erect instead of nodding heads. If *Artemisia Bakeri* should be reduced to a variety of *A. mexicana*, *A. Wrightii* should also. *A. stenoloba* Rydberg was never described, but the specimens so named in manuscript belong to *kansana*. There is however, an older name for this species, viz., *A. Carruthii* Wood, as pointed out by Mr. Mackenzie.

Artemisia rhizomata A. Nels., *A. pudica* Rydb., *A. pabularis* (A. Nels.) Rydb., *A. Purshiana* Besser, and "probably" *A. candicans* and *A. floccosa* Rydb. are reduced to synonyms of *A. gnaphalodes* Nutt. If *A. rhizomata* and *A. pabularis* (originally described as a variety by Nelson) are reduced to synonymy I shall enter no protest. I do not know what the first really is. One specimen in the Columbia herbarium bears the type number, but it does not agree with the original description and the label evidently has been interchanged. Some of the specimens distributed later under that name belong to the form of *A. gnaphalodes* common in the Rocky Mountain region. The form growing in Wisconsin, the type state of *A. gnaphalodes*, looks quite different, although it is almost impossible to characterize the differences in words. *Artemisia pabularis* is a peculiar plant, in some respects intermediate between *A. gnaphalodes* and *A. microcephala* Wooton, but with narrower leaves than either. *A. pudica* Rydb. is related to *A. gnaphalodes* and *A. diversifolia*, but in my opinion distinct. This is, of course, a matter of individual opinion. *A. Purshiana* is a northern plant with much broader leaves and denser inflorescence than the ordinary *A. gnaphalodes*. It is common in British America and Montana, has been collected in the Dakotas, and one specimen from Nevada I have referred doubtfully here, but I have seen no specimens from Wyoming or southward. Perhaps this species is unknown to Professor Nelson.

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*Proc. Am. Acad. 25: 133. 1890.

†Hook. Fl. Bor.-Am. 1: 325. 1833.

I must protest, however, against the reduction of *Artemisia candicans* Rydb., and *A. floccosa* Rydb. to synonyms of *A. gnaphalodes*. *Artemisia floccosa*, as stated above, should take the place of *A. paucicephala* and *A. gracilenta*, and the *A. candicans* is related to it. Using Nelson's key, one would place it in *A. paucicephala*, but the heads are still broader, sessile in small clusters, nodding or spreading, instead of erect, and the tomentum is more loose.

Artemisia Underwoodii Rydb., *A. Brittonii* Rydb. and *A. latiloba* (Nutt.) Rydb. are made synonyms of *A. ludoviciana* Nutt. I doubt if Professor Nelson knew what the first two are. One specimen of *A. Underwoodii*, viz., *Goodding 1934*, was distributed from the University of Wyoming under the name *A. silvicola* G.E.O. Both *A. Underwoodii* and *A. silvicola* are perhaps more closely related to *A. mexicana* than to *A. ludoviciana*.

Artemisia Brittonii Rydb. has the leaves permanently tomentose on both sides and would be placed in *A. gnaphalodes* if Nelson's key were used. It is most nearly related to *A. Purshiana*, but has at least the lower leaves deeply lobed.

Artemisia latiloba (Nutt.) Rydb. should be known as *A. Hookeriana* Besser. I have seen a duplicate of the latter in the Gray herbarium and there is no doubt that it is the same as my *A. latiloba*. It is a northern plant, not found in Wyoming and rare in Montana. It has the same leaf-form as *A. elatior* and *A. Suksdorfii*, but the inflorescence is denser and the involucre is densely tomentose. It is sometimes hard to distinguish from, and in the west seem to grade into, what has been known in California and Nevada as *A. heterophylla* Nutt. The latter name is untenable and belongs evidently to *A. Suksdorfii.* The California-Nevada plant has been described as *A. Kennedyi* A. Nels., but even this must pass into synonymy, for the plant has an older name, *A. Douglasiana* Besser.

Under *Artemisia discolor* is given as a synonym: "*A. elatior* (T. & G.) Rydb. as to our range." *A. discolor* and *A. elatior* can never be confused, but perhaps this could happen with the latter and *A. incompta* Nutt., which Nelson has regarded as a variety of *A. discolor*, following Dr. Gray. Good specimens of *A. elatior*, resembling the type in the Columbia University herbarium, have been collected in Montana and one specimen which I can refer to no other described species we have from Colorado.

Artemisia spiciformis Osterhout is reduced to a synonym of *A. arbuscula* Nutt. It is not related to that species but is related to *A. Rothrockii* A. Gray. The specimens from Utah collected by Ward and Parry and referred to by Dr. Gray,* belong to *A. spiciformis* Osterhout.

Nelson has also reduced several species to varieties, viz., *A. Parryi* A. Gray, *A. coloradensis* Osterhout, *A. diversifolia* Rydb., *A. silvicola* Osterhout, and *A. Bakeri* Greene.

There is scarcely any better species than *A. Parryi* and it can never be justly referred to *A. saxicola.* Not only has the plant "a tendency to become glabrate," but the pubescence, if any is present, is not that of *A. saxicola*, but is short-silky and appressed, the heads are usually much more numerous than in that species and not racemose, and the corollas are perfectly glabrous. If it were not for the absolute lack of tomentum I should place it next to *A. franserioides* and *A. discolor.* It is strange that Professor Nelson reduced this species to a variety, while he regarded *A. Pattersonii* as distinct from *A. scopulorum.* Besides, what rules of nomenclature was he following, when he reduced the older species *A. Parryi* to a variety of the later *A. saxicola?*

Artemisia coloradensis Osterhout is made a variety of *A. Wrightii.* As *A. Wrightii* of Nelson is not the original *A. Wrightii* A. Gray, but *A. kansana* Britton (see above), a new combination is necessitated, if the specific rank of *A. coloradensis* is not upheld.

Artemisia diversifolia Rydb. is made a variety of *A. gnapha-*

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*See Syn. Fl. 1^2: 375.

lodes Nutt. This is of course a matter of individual opinion. It is fully as good as the two Nelsonian species *A. aromatica* and *A. nova*, which I am inclined to admit.

Artemisia silvicola Osterhout and *A. Bakeri* Greene are made varieties of *A. mexicana*. The former is, as stated before, related to *A. mexicana*, but the latter is very hard to distinguish from the original *A. Wrightii*. *A. mexicana* is not found in the Rockies and not even near them. What goes under that name from New Mexico and Arizona is mostly either *A. neo-mexicana* Greene or *A. microcephala* Wooton. The latter extends into southern Utah and Nevada.

So many species have already been proposed in this genus that it may seem a little hazardous and unnecessary to add more to the already too large number. There are, however, two plants, both collected by *Bourgeau* on the Palliser Expedition in Saskatchewan, that can not be included in the species known by me, so that it seems better to give descriptions of them here. The second one was rediscovered in Alberta by Macoun and Herriot.

Artemisia Bourgeauana sp. nov.

Perennial with a tap-root and short caudex; stem silky-pubescent, more or less tinged with red, 3–4 dm. high; basal leaves petioled, 4–6 cm. long, sericeous-canescent on both sides, twice-pinnatifid with oblanceolate divisions; stem-leaves pinnatifid with linear, crowded divisions, rather small; heads numerous in a narrow panicle; involucres nearly 5 mm. wide, silky-villous, yellowish and shining; bracts oval, broadly scarious-margined; flowers light yellow, the central ones sterile.

This species is perhaps most closely related to *Artemisia Forwoodii*, having the same habit and leaf form, but the plant is more silky and the heads are twice as broad, fully as large as in *A. spithamaea* and *A. canadensis*. From the former it differs in the numerous heads, compound inflorescence, yellow instead of brown flowers, and taller stem. From *A. canadensis* it differs in the compact inflorescence, the densely silky leaves, and broader leaf-segments.

SASKATCHEWAN: 1857–9, *Bourgeau* (type, in herb. Columbia University).

Artemisia Herriotii sp. nov.

Perennial with a rootstock; stem 6–10 dm. high or more, tomentose; leaves entire or sparingly and sharply toothed, 5–20 cm. long, 5–15 mm. wide, glabrate and green above, densely white-tomentose beneath, rather thin, margins not revolute; inflorescence a narrow compact panicle with very numerous small heads; branches erect, racemiform; heads erect; involucres about 5 mm. high, 2.5–3 mm. broad; bracts oblong-ovate to ovate, acute or obtuse, yellowish, densely tomentose; flowers yellow, the central ones fertile; receptacle naked.

Bourgeau's specimens were referred to *Artemisia longifolia* by Dr. Gray, but they are not closely related to that species. The leaves are not revolute-margined and the heads are not half the size of those of that species. It is most closely related to *A. silvicola* and *A. Hookeriana* Besser (*A. latiloba* Rydb.). It differs from the former in the denser and narrower inflorescence, the erect heads, the denser tomentum on the involucres, and the firmer leaves, and from the latter in the more entire leaves and the smaller, more cylindric heads.

ALBERTA: Edmonton, Aug. 25, 1906, *Macoun & Herriot 72825* (type, in herb. N. Y. Bot. Gard.).

SASKATCHEWAN: 1858, *Bourgeau* (in herb. Gray).

ACHILLEA

A great diversity of opinion exists among botanists as to the number of species of this genus found in America. Dr. Gray admitted three species, *Achillea Millefolium*, *A. multiflora*, and *A. Ptarmica*. Evidently Nelson held the same view, as he admits only *A. Millefolium*, the other two not being found in the Rocky Mountain region. Piper in his Flora of Washington* admitted *A. lanulosa* Nutt. as variety of *A. Millefolium*. Robinson and Fernald† regarded *A. lanulosa* as a good species. Pollard‡ admitted 10 species as North American. Of these one is Mexican and three escaped or introduced. Afterwards he, in coöperation with Cockerell,§ described an additional species from New Mexico. With the exception of *A. multiflora* and perhaps *A. laxiflora*, which is unknown to me, all the North American species are closely related to *A. Millefolium* and may be only forms of that species. Notwithstanding the fact that *Achillea borealis*, on account of its large heads and numerous rays, has been placed in the *Ptarmica* section of the genus, it is closely related to *A. Millefolium*, and can be connected with it through two different lines of relationship. (See below.) It is very hard to say whether the native species of the *Millefolium* group admitted by Pollard should be regarded as species or as varieties of *A. Millefolium* and my intention here is not to express any opinion on that subject. I only wish to clear certain points regarding which there seems to be a great deal of confusion. I shall here use the specific names that have been applied to the different forms, whenever such are available.

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*Contr. U. S. Nat. Herb. vol. 11.

†Gray's New Manual 845.

‡Bull. Torrey Club **26**: 365–375. 1899.

§Proc. Biol. Soc. Wash. **15**: 179. 1902.

ACHILLEA MILLEFOLIUM L. Sp. Pl. 899. 1753

This is a native of northern Europe and I think also of northern New York and New England and eastern Canada; at least it has naturalized itself in that part of North America. Elsewhere it is only sparingly introduced. It is a characteristic northern plant. It differs from all the other native forms in being less villous and having shorter hairs. The rachis of the leaves is distinctly wing-margined and the primary segments more or less decurrent; they are usually decidedly spreading. The secondary segments are short, lanceolate, and spinulose-tipped. The rays are comparatively large, 2–3.5 mm. broad. The bracts have usually brown margins. In the far north, the plant often becomes more hairy and the margins almost black, and it approaches *A. borealis* on one hand and *A. lanulosa* on the other. Of such specimens we have one from North Iceland, collected by Olasur Davidson, and two collected by Collins and Fernald, one at Carleton Point, Que., in 1904 (labeled *A. lanulosa*) and the other at Mt. Albert, Que., in 1906, *no. 257* (labeled *A. borealis*).

Achillea occidentalis Raf.; DC. Prod. **6**: 24. 1837, as a synonym under

A. Millefolium occidentalis DC. *loc. cit.*

A. Millefolium Pollard, Bull. Torrey Club **26**: 371, in part. 1899. Not *A. Millefolium* L. 1753.

This is evidently the plant that Pollard took for the real

Achillea Millefolium. It is characterized by the small rays, only 1.5–2.5 mm. broad, and straw-colored bracts, pointed out by Pollard. It differs also from *A. Millefolium* in the narrow linear and usually more elongated segments of the leaves. There is also only a trace of a wing-margin on the rachis and the stem is usually more hairy and with longer hairs. DeCandolle regarded it as a variety of *A. Millefolium* and stated that it is intermediate between that species and *A. setacea*, a native of Southern Europe. In my opinion it is nearer to *A. setacea*, having the small rays and narrow segments of that species, but is more hairy. It is the common native form of the prairie region from Wisconsin to Kentucky, Arkansas, and eastern Nebraska, but specimens have been collected as far east as Pennsylvania and South Carolina. Three specimens from southern Colorado I have also referred here.

ACHILLEA LANULOSA Nutt. Journ. Acad. Nat. Sci. Philadelphia **7**: 36. 1834

A. tomentosa Pursh, Fl. Am. Sept. 561. 1814. Not *A. tomentosa* L. 1753.

This resembles the foregoing in many respects; the pubescence (although often more copious) and the color of the bracts are the same. The segments of the leaves are much shorter and more crowded and more directed forward; the rachis has not even a trace of a wing margin and the rays are much larger, 2.5–4 mm. (Pollard gives them up to 6 mm.) broad. This is the common plant of the Rocky Mountain region and its range extends from Saskatchewan to Kansas, New Mexico, northern Mexico, the mountains of California, and British Columbia.

ACHILLEA SUBALPINA Greene, Leaflets **1**: 145. 1905

A. lanulosa alpicola Rydb. Mem. N. Y. Bot. Gard. **1**: 426. 1900.
A. alpicola Rydb. Bull. Torrey Club **33**: 157. 1906.

This resembles a depauperate *Achillea lanulosa* in habit, but the margins of the bracts are strongly colored, usually almost black, though sometimes only brown, and such specimens approach closely *A. lanulosa.* The inner bracts as are a rule decidedly acute and in this respect it resembles *A. borealis.* It differs, however, from that species in the small heads, not over 4 mm. broad, the less numerous rays, and the short and crowded leaf-segments. It belongs to the higher Rocky Mountains.

ACHILLEA BOREALIS Bong. Veget. Sitcha 149. 1832

In many respects this is close to the typical *Achillea Millefolium*. The heads are usually larger and have more rays; the bracts are usually darker but not always so. The main differences are in the inner bracts, which are decidedly acute, the narrow and usually long segments of the leaves, the rachis, which is almost without a wing margin, and the longer pubescence. The leaves resemble much those of *A. occidentalis* and *A. californica*. The range of *A. borealis* extends from the Mackenzie to Alberta, British Columbia, and Alaska. The plant of Newfoundland and Labrador, which has been referred to this species is somewhat different. So far as I know, it has not received any specific name, but it has been described under the following name:

ACHILLEA MILLEFOLIUM NIGRESCENS E. Meyer, Pl. Labrad. 65. 1830

It has the large heads and dark-margined bracts of *A. borealis*, but the bracts are not acute, the leaf-segments are broad and short, and the rachis has a decided wing-margin. It agrees therefore in every respect with *A. Millefolium*, except the larger head and the more numerous flowers.

ACHILLEA CALIFORNICA Pollard, Bull. Torrey Club **26**: 369. 1899

This, so far as I know, is not found in the Rocky Mountain region. It is restricted to the Pacific Coast. It is usually taller and more robust than any of the species mentioned above. The character of the head is practically the same as in *A. Millefolium*, but the heads are larger, about as large as in *A. borealis*. The margins of the bracts are usually not so dark as in that species and none of the bracts are acute. The leaf-form is more that of *A. borealis* and *A. occidentalis*, but the segments are usually still more elongated and more divaricate. The leaves are usually thrice rather than twice pinnatifid.

ACHILLEA ARENICOLA Heller, Muhlenbergia 1: 61. 1904

This resembles in many respects the preceding but is much more copiously villous than any of the other species. The inflorescence is compact and of many large heads. The leaf-segments are short and crowded as in *A. lanulosa*, but the plant is stouter, the heads much larger and the margins darker. It has been mistaken for *A. borealis*, but has neither the blackish margins nor the acute inner bracts of that species.

ACHILLEA GIGANTEA Pollard, Bull. Torrey Club **26**: 370. 1899, and

ACHILLEA LAXIFLORA Pollard & Cockerell, Proc. Biol. Soc. Wash. 15: 179. 1902, are both unknown to me.

The species or forms discussed above are fairly distinct when typical specimens from the centers of their distribution are compared. It must be admitted that intermediate forms are not altogether lacking. Intermediate forms between *Achillea Millefolium* and *A. Millefolium nigrescens* have been collected in Newfoundland. In northern New England *A. Millefolium* seems to be the only species. In New York, New Jersey, and Pennsylvania, both this and *A. occidentalis* are found, but intermediate forms seem to be very rare. In the center of distribution of *A. occidentalis*, viz., in Wisconsin, Illinois, Iowa, and Kentucky, *A. Millefolium* seems to be unknown, while in the north it has been collected in Manitoba, Saskatchewan, Alberta, and even British Columbia. It has been found also in Colorado; but judging from the localities, these specimens might have been escapes from cultivation. I have seen yarrows planted around miners' cabins. From Colorado and Nebraska I have seen a few specimens that were somewhat intermediate between *Achillea occidentalis* and *A. lanulosa*, but in almost every case they could be referred either to one or the other. *A. lanulosa* and *A. subalpina* both belong to the Rockies, but they grow at different altitudes; the former grows also on hillsides of the Great Plain region and at an altitude of 1000–3500 m.; the latter only in the high mountains at an altitude of 3000–4000 m. Hence at an altitude of 3000–3500 m., they are both found. Here intermediate forms might be expected. In California both *Achillea lanulosa* and *A. californica* are found, but

I have seen no intermediate forms. There are several specimens from Utah, Idaho, and Washington which I refer to *A. lanulosa*, though they approach *A. californica* in the stoutness of the plant and the larger heads. From Washington I have seen a specimen intermediate between *Achillea californica* and *A. borealis* and another between *A. arenicola* and *A. borealis*. *Achillea borealis* is not found in the Rockies within the United States and *A. subalpina* not in British America outside of the Rockies. The only specimen which I refer to *A. borealis* though approaching *A. subalpina*, is from the Canadian Rockies of Alberta.

Petasites corymbosa (R. Br.) Rydb. comb. nov.

Tussilago corymbosa R. Br. in Chloris Melv. 21. 1823.

Petasites palmata frigida Macoun, Cat. Canad. Pl. **1**: 553. 1886. Not *P. frigida* (L.) Fries. 1845.

This has been included in *Petasites frigida* (L.) Fries, but differs in the deeply lobed leaves, the lobing extending one third to one half the distance to the midrib. It is the more common plant of the Canadian Rockies, known as *P. frigida*.

ARNICA

This genus, as represented in western North America is one of the most perplexing, and the last word concerning it is far from being said. I doubt if all the species proposed by Dr. Greene and Professor A. Nelson can be maintained. One of my own, *Arnica monocephala*, must be regarded as a low broad-leaved form of *A. pedunculata*, and *A. tenuis* Rydb. might be an entire-leaved and monocephalous form of *A. Rydbergii* Greene. On the other hand there are evidently forms of this genus that have not been described.

Considerable confusion has existed in regard to *Arnica Chamissonis* Lessing and *A. mollis* Hook. Gray in his Synoptical Flora united the two. In the old Torrey herbarium there are two specimens. One of these bears the printed label "*Arnica Chamissonis* Lessing, Unalaschka" and was received from St. Petersburg. It is evidently from the original collection. It is a plant of the *A. foliosa* group, with longer loose villous pubescence. We have several specimens similar to it from British Columbia, Alberta, and Saskatchewan and at least one from Montana. The other specimen is a duplicate of the type of *A. mollis*, received from Hooker. This is almost identical with *A. subplumosa* Greene, or *A. Chamissonis longinodosa* A. Nels., except that the involucral bracts are broader, oblanceolate, and abruptly short-acuminate. It represents a plant not uncommon in the Rockies, from northern Wyoming northward. The *Arnica* that is not uncommon in New England was referred to *A. Chamissonis* in Gray's Manual, 6th edition, and to *A. mollis* by Robinson & Fernald in the Gray's New Manual. It has nothing to do with the former. It is related to the latter, but is, I think, distinct enough. It has more affinity to *A. amplexifolia* Rydb. (*A. amplexicaulis* Nutt.) and *A. rivularis* Greene than to *A. mollis* Hook. It does not have the broad bracts of *A. mollis*. It should be known as *Arnica lanceolata* Nutt. A duplicate of the type (if not the actual type) of the last named is found in the Torrey herbarium.

What Professor Nelson had in mind as *Arnica mollis* when preparing the manuscript of the New Manual, I can not imagine. In his key he separates it from *Arnica subplumosa* by the "leaf blades decurrent on the petioles." The blades are slightly and but slightly decurrent in both. His description is very vague and evidently drawn from several species. As synonyms he cites "*A. Chamissonis* in part, but mostly *A. latifolia* as to our range (*A. latifolia* A. Gray, Bot. Calif. **1**: 415. 1885; *A. tomentulosa* Rydb. *loc. cit.* **28**: 20. 1901)." It is true that Gray and others referred *A. mollis* to *A. Chamissonis*, but I do not know that it has been referred to *A. latifolia*, unless by Prof. Nelson. *Arnica latifolia* A. Gray in the Botany of California comprises *A. latifolia* Bong., *A. Menziesii* Hook. (this perhaps not specifically distinct from *A. latifolia*) and *A. diversifolia* Greene (*A. latifolia viscidula* A. Gray). None of them has anything to do with *A. mollis*. *A. tomentulosa* Rydb. is related to *A. Chamissonis* Less., but differs in the short pubescence and the broad involucral bracts, rounded at the apex. If the form of the bracts should happen to be a variable character and of no specific value, Nelson's own *Arnica rhizomata* should be reduced to a synonym of *A. tomentulosa*, as there are practically no important differences except the form of the bracts and the latter name is nearly five months older.

Greene's idea of *Arnica Chamissonis* is also wrong. He states under *A. columbiana*: "It can not be referred to *A. Chamissonis*, since it lacks the distinctly obovate leaf-cut, the broad, short disk-corollas and the tawny subplumose pappus of that species." These characters belong to *A. mollis*, not to *A. Chamissonis*.

There are more exceptions to be made to the treatment in the New Manual. Under *Arnica ventorum* Greene are given as synonyms *A. platyphylla* A. Nels. and *A. grandiflora* Greene. I have not seen the type of *A. platyphylla*, but *A. grandiflora* Greene is closely related to *A. cordifolia* Hook., and is not of the *A. latifolia* group. One specimen collected by R. S. Williams and referred to *A. platyphylla* by Nelson in his original publication is exactly like a specimen sent to Dr. Torrey as *A. Menziesii* by Dr. Hooker and included by him in his Flora. Both of these are very close to the original *Arnica latifolia* Bong., of which there is a duplicate in the Torrey herbarium. The only essential difference is that *A. latifolia* has perfectly glabrous achenes, while in *A. Menziesii* and Williams' plant the achenes have a few scattered hairs toward the upper end and are sparingly glandular-granuliferous.

Arnica sylvatica Greene is made a variety of *A. subplumosa*, and specimens distributed from the University of Wyoming under the name *Arnica subplumosa sylvatica* are nothing but a low-stemmed *A. subplumosa*. But the original *A. sylvatica*, of which there are two duplicates in the herbarium of the New York Botanical Garden, is quite different. It has cordate basal leaves and coarsely and saliently toothed stem-leaves. It is related to *A. diversifolia* Greene (*A. latifolia viscidula* A. Gray).

Professor Nelson has also united *Arnica fulgens* Pursh and *A. pedunculata* Rydb. What the original *A. fulgens* was, I do not really know, as I have not seen Bradbury's specimen; but *A. fulgens*, as interpreted by myself and by Piper,* has a horizontal slender rootstock, without any tufts of brown hairs, while *A. pedunculata*, including *A. monocephala* Rydb., is characterized by its short, thick, almost erect rootstock, with dark brown hair-tufts in the manner of *Plantago eriopoda*. It is the only species in North America that has this character, so far as I know.

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*Contr. U. S. Nat. Herb. **11**: 590 and 592.

Arnica caudata Rydb. sp. nov.

Perennial, with a short cespitose rootstock; stems 2–3 dm. high, leafy, villous, and densely glandular-puberulent; leaves nearly erect, linear-lanceolate, mostly sheathing at the base, densely glandular-puberulent and with scattered villous hairs, 5–10 cm. long, 5–8 mm. broad, caudate-attenuate at the apex, with entire, somewhat revolute margins; heads mostly 3, cymose, with the lateral peduncles usually exceeding the terminal one; involucres turbinate, about 1 cm. high, glandular-puberulent and hirsute; bracts linear-lanceolate, almost subulate, attenuate; ligules nearly 1 cm. long, 1–1.5 mm. broad, deeply toothed or cleft; achenes slender, cylindric, glandular-granuliferous, and sparingly hispidulous; pappus short, sordid, plumose; corollas more or less pubescent.

This species is perhaps related to *Arnica longifolia* but is easily distinguished by the low habit, the caudate-attenuate leaves, and the hirsute as well as glandular-puberulent bracts.

UTAH: Big Cottonwood Cañon, near Lake Catherine, Aug. 3, 1905, alt. 9300 ft., *A. O. Garrett 1547* (type, in herb. N. Y. Bot. Gard.).

SENECIO

The original *Senecio Bigelovii* was collected by Bigelow on the Whipple Expedition and a specimen is in the herbarium of Columbia University. It differs from all that have been known under that name in later years by the lower leaves having long petioles and ovate-lanceolate blades. The petioles are longer than the blades, and the latter are abruptly contracted below. In *S. chloranthus* Greene and *S. contristatus* Greene the basal leaves have comparatively short petioles, and the blades taper gradually below. These two species, which it may be, should be united in one, are therefore fully as distinct from *S. Bigelovii* as is *S. scopulinus* Greene. The latter is acknowledged as a variety in Coulter & Nelson's New Manual under the name *S. Bigelovii Hallii* A. Gray. It is in reality much closer to *S. chloranthus* than either is to *S. Bigelovii*. Dr. Greene* in proposing *S. scopulinus* says: "True *Bigelovii* is still unknown except from southern New Mexico, and is of very different aspect, with thin and not at all succulent deep-green herbage, usually no trace of any pubescence, but consisting of short stiff straight hairs whenever present. This, the real *S. Bigelovii*, was distributed by Mr. Wooton, from the White Mountains of New Mexico, as *S. Rusbyi*, an error for which I am solely responsible. The species is nearer to *S. Rusbyi* than it is to *S. scopulinus*, which latter I have until recently assumed to be the typical *S. Bigelovii*." These statements of Greene are correct in as far as that the specimens distributed by Wooton and referred to by Greene are the most like the original *S. Bigelovii* of any that we have in the herbarium of the New York Botanical Garden, but Wooton's specimens have narrow leaves, the blades of the basal ones are not abruptly contracted at the bases, and the heads are smaller than in *S. scopulinus*, while those of the type of *S. Bigelovii* are much larger, even larger than those of *S. contristatus*.

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*Pittonia 4: 117–118.

The treatment of *Senecio* in the New Manual of the Botany of the Central Rocky Mountains is fairly good. There are many cases, however, in which the authors have reduced species to synonymy under closely related species, where the writer is inclined to keep them distinct, but where this is merely a matter of difference of opinion. But there are other cases in which such reductions are wholly unwarranted, misleading, and destructive to real science. Such a case for instance, is where *Senecio solitarius* Rydb. is made a synonym of *S. subnudus* DC. A mere reading of the description of the former would show that it is related to the group comprising *S. integrifolius* Nutt., *S. columbianus* Greene, *S. perplexus* A. Nels. etc., while *S. subnudus* is related to *S. aureus*. Another case is where *Senecio Flintii* Rydb. is made a synonym of *S. glaucescens* Rydb. The former is closely related to *S. exaltatus* Nutt. and has a short crown with fascicled roots, characteristic of the *S. integrifolius* group, while *S. glaucescens* has a distinct rootstock, and is related to *S. anacletus* Greene.

Under *Senecio perplexus* A. Nels. we find the following statement: "(*S. columbianus* Rydb. in Fl. Col., not *S. columbianus* Greene, of which *S. atriapiculatus* Rydb. is a synonym.)" The true typical *Senecio columbianus* Greene is found in Colorado and not uncommon. The only question in my mind is whether *S. perplexus* A. Nels. is really specifically distinct. The only difference is the more distinct toothing of the leaves of the former and the tendency of the upper stem-leaves to be narrower and more distinctly auriculate-clasping. *S. columbianus* and *S. perplexus* are really more closely related to each other than *S. dispar* A. Nels. is to *S. perplexus*, of which Professor Nelson has made it a variety.

Both *Senecio Harbourii* Rydb. and *S. Howellii* Greene have been made synonyms of *S. canus*. Before I published the former I visited the Gray Herbarium and had a conference with Dr. Greenman. I found that two of the species I had in manuscript he also intended to publish, viz., *S. Harbourii* Rydb. and *S. multicapitatus* Greenm. I published the latter under Greenman's name, and retained my own for the former. *S. multicapitatus* Greenm., Professor Nelson reduces to a synonym of *S. Riddellii* T. & G. I know that at least a few years ago, Dr. Greenman, our best student of *Senecio*, regarded both *S. Harbourii* and *S. multicapitatus* as good species. In Piper's Flora of Washington,* *S. Howellii* is kept distinct from *S. canus*. The manuscript of the genus was prepared by the aid of Dr. Greenman.

Senecio salicinus Rydb., *S. canovirens* Rydb., and *S. lanatifolius* Osterhout are given as synonyms of *S. Fendleri*. *S. salicinus* is more closely related to *S. rosulatus* Rydb. than to *S. Fendleri*. The other two are somewhat related to *S. Fendleri* but I think perfectly distinct, having an altogether different foliage. *S. lanatifolius* has besides discoid heads.

Regarding *Senecio rosulatus* Rydb., I may say that when that species was proposed we had but one sheet of *S. Nelsonii* and that not a duplicate of the type. This sheet bears two undeveloped plants, one of them evidently belonging to the variety *uintahensis*. My conception of *S. Nelsonii* was therefore rather *S. uintahensis* A. Nels. I am willing therefore to accept *S. rosulatus* as a synonym.

Senecio uintahensis A. Nels. is related to *S. multilobatus* T. & G., as Nelson indicates; but the latter is not a winter annual or biennial, but a perennial with a tap-root, just as *S. uintahensis* is.† The main differences are that *S. multilobatus* is more glabrous,

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*Contr. U. S. Nat. Herb. **11**: 599.

†See Bull. Torrey Club **27**: 170 and 172.

has narrower divisions to the stem-leaves, and has hispidulous instead of glabrous achenes.

Under *Senecio cymbalarioides* Nutt., in the New Manual is given the following: "(*S. Jonesii*, S. *subcuneatus*, *S. acutidens* Rydb. * * * and *S. oodes* Rydb. * * * seem to be impossible to discriminate satisfactorily)." *S. subcuneatus* and *S. acutidens*, especially the latter, are closely related to *S. cymbalarioides*, but the others are not. *S. Jonesii* is more closely related to *S. uintahensis* than to *S. cymbalarioides* and is perhaps not specifically distinct. If not, *S. Jonesii* is the older name and should be used.

Senecio Hartianus Heller is given as a synonym of *S. pseudaureus* Rydb. Professor Nelson may have been led astray by myself, for the specimens referred to *S. Hartianus* in my Flora of Colorado are but depauperate specimens of *S. pseudaureus*. The true *S. Hartianus* is closely related to *S. flavulus* Greene.

Senecio pyrrochrous Greene and *S. Tracyi* Rydb. are made synonyms of *S. longipetiolatus* Rydb. They are both more related to *S. pseudaureus*, having cordate or reniform, although entire, basal leaves, while in *S. longipetiolatus* the basal leaves are narrow and oblanceolate, tapering into the petioles.

Senecio fediifolius Rydb. and *S. nephrophyllus* Rydb. are made synonyms of *S. discoideus* (Hook.) Britton, perhaps because all three have usually discoid heads. The original descriptions show that they are entirely different plants. *S. discoideus* should be replaced by *S. pauciflorus* Pursh, which is an older name. Greenman and Blankinship* think that *S. nephrophyllus* is the same as *S. debilis* Nutt. I have not seen the type of the latter and can not express any opinion.

Dr. Greenman some years ago called my attention to the fact that the plant usually known as *Senecio eremophilus* Richardson, does not agree with the original. There is a duplicate of the latter in the Columbia University herbarium and it differs from the Colorado plant in the larger heads, which are 10–12 mm. high and about 1 cm. wide and ascending or spreading instead of erect. In the Colorado plant the heads are less than 1 cm. high. *S. eremophilus* is a northern plant, its range extending from Manitoba to

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*See Supplement to the Flora of Montana 102.

North Dakota, Montana, and northward far down the Mackenzie. Dr. Greenman thought that the Colorado plant should be referred to *S. MacDougalii* Heller, and so I adopted that view in the Flora of Colorado. I have seen two specimens from Colorado which may be included in *S. MacDougalii*, but the rest belong to what I think should be recognized as a distinct species.

Senecio ambrosioides sp. nov.

Senecio eremophilus Porter & Coulter, Syn. Fl. Colo. 82, mainly. 1874. Not *S. eremophilus* Richards.

Senecio MacDougalii Rydb. Fl. Colo. 397. 1906. Not *S. MacDougalii* Heller. 1899.

Perennial, with a stout rootstock; stem glabrous, leafy, 4–10 dm. high; leaves lanceolate or oblanceolate in outline, pinnatifid to near the midrib or the lower incised, glabrous, all except the uppermost short-petioled, the lobes lanceolate, coarsely dentate or incised; heads numerous, corymbose-paniculate, 9–10 mm. high, erect; involucres glabrous, 6 mm. high and about as broad; bracts carinate, linear, acute, with black tips, the calyculate ones subulate, 4–5 mm. long; ligules light yellow, 5–6 mm. long, 1.5–2 mm. wide; achenes minutely scabrous-puberulent on the angles.

This species differs from *Senecio MacDougalii* in the larger heads (in *S. MacDougalii* only about 7 mm. high), more campanulate involucres, lanceolate instead of linear divisions of the leaves, and the achenes scabrous-puberulent on the angles. From *S. eremophilus* it differs in the smaller and erect heads (in *S. eremophilus* 10–12 mm. high), shorter rays, and smaller leaves. *S. ambrosioides* grows in damp places at an altitude of 1800–3000 m.

Colorado: Green Mountain Falls, El Paso County, Aug. 2, 1892, *C. S. Sheldon* (type, in herb. N. Y. Bot. Gard.); above Beaver Creek, July 8, 1896, *Crandall 3030;* Pagosa Peak, 1899, *Baker 706;* Parrott City, 1898, *Baker, Earle & Tracy 475;* Ute Pass, 1896, *Clements 190;* Colorado Springs, July, 1893, *Saunders;* Parlin, Aug. 16, 1901, *B. H. Smith 127;* Ruston Park, 1901, *Clements 152;* Mesa Yempa, 1898, *Shear 3943;* Chambers Lake, 1896, *Baker;* Ute Pass, 1896, *Shear 3695;* mountains between Sunshine and Ward, 1902, *Tweedy 4863;* Empire, 1903, *Tweedy 5783;* Silver Plume, 1895, *Shear 4999;* La Veta, 1896, *Clements 166;* Silver Plume, *1894, E. A. Bessey;* Georgetown, 1878, *M. E. Jones 728;* Gunnison, 1901, *Baker 596.*

WYOMING: Bridger Peak, 1903, *Goodding 1942;* between Sheridan and Buffalo, 1900, *Tweedy 3034;* Upper Buffalo Fork, 1899, *C. C. Curtis;* Centennial Mountain, Albany Co., 1902, *Aven Nelson 8773;* also 1900, *7719;* Copperton, 1901, *Tweedy 4136;* Eastern slope of Big Horn Mountains, 1900, *Tweedy 3033.*

NEW MEXICO: Mineral Creek, 1904, *Metcalfe 1415;* Santa Fé Cañon, 1897, *Heller 3819.*[1]

Senecio Kingii sp. nov.

Senecio eremophilus D. C. Eat., Bot. King's Exp. 191. 1871. Not *S. eremophilus* Richards. 1823.

Perennial, with a thick rootstock; stems glabrous, 3–6 dm. high, rather stout, leafy; leaves obovate or oblanceolate in outline, 4–7 cm. long, the lower petioled, all pinnately lobed one third to one half the distance to the midrib, with ovate or lanceolate, more or less toothed lobes; heads numerous, corymbose-paniculate, 9–11 mm. high; involucres glabrous, campanulate, 7–8 mm. high, 6–7 mm. broad; bracts linear, acute, carinate, sometimes with small black tips; the calyculate ones few, subulate; rays 5–7 mm. long; achenes scabrous-papillose on the rounded angles.

This species is related to *S. eremophilus*, but differs in the somewhat smaller and erect heads, less deeply dissected leaves, and their broad and short divisions, and shorter rays. One of the specimens cited below was determined some years ago as *S. glaucifolius*, but that species differs from this as well as from the rest of the group in the narrower and scarcely carinate bracts.

UTAH: Cottonwood Cañon, Aug. 1869, *S. Watson 676* (type, in herb. Columbia University); Alta, Wahsatch Mountains, 1879, *M. E. Jones 1144;* American Fork Cañon, July 1895, *M. E. Jones;* Big Cottonwood Cañon, Aug. 1905, *Garrett 1591;* near Marysvale, 1905, *Rydberg & Carlton 7068;* Mount Barrette, *7206;* Fish Lake, *7506.*

Senecio Leonardi sp. nov.

Perennial, with a short rootstock; stem 4–5 dm. high, loosely floccose; basal leaves long-petioled; petioles 5–15 cm. long; blades obovate or oval, 2–6 cm. long, densely crenate, rather thick, loosely floccose, or in age glabrate, rounded at the apex; lower stem-leaves similar but with shorter petioles, the middle ones more or less lyrate-pinnatifid at the base; upper stem-leaves 1–3 cm. long, lanceolate in outline, pinnately lobed and somewhat auriculate-clasping; heads in a rather dense corymb, 8–9 mm. high; involucres somewhat turbinate and floccose at the base, 5–6 mm. high, 6–7 mm. broad; bracts linear, acute, carinate, brownish-black on the backs, yellowish brown on the margins; rays orange, about 6 mm. long, 2 mm. wide; achenes glabrous.

This species resembles most the eastern *Senecio tomentosus* in habit and pubescence, but differs in the shorter blades of the basal leaves, which are obovate or oval instead of ovate, in the dark involucres, and the glabrous achenes. It grows in meadows at an altitude of 1500–2000 m.

Utah: Near divide, head of American Fork Cañon, July 29, 1885, *Leonard 143* (type, in herb. N. Y. Bot. Gard.); Wahsatch County, near Midway, July 6, 1905, *Carlton & Garrett 6701*.

Senecio Tweedyi sp. nov.

Senecio flavovirens Rydb. Bull. Torrey Club **27**: 181, in part. 1900.

Senecio Balsamitae A. Nels., Coult. & Nels. New Man. Cent. Rocky Mts. 583, in part. 1909.

Perennial, with a rootstock; stem glabrous, or slightly floccose at the leaf-axils, 4–6 dm. high, striate; basal leaves 3–15 cm. long, petioled; blades elliptic or oval to oblanceolate, crenate-dentate, often lyrate-pinnatifid with a few lobes below the large terminal one; lower stem-leaves similar, but more pinnatifid; upper stem-leaves deeply pinnatifid, with oblong toothed divisions; heads corymbose, 9–10 mm. high; involucres glabrous, somewhat turbinate at the base, about 8 mm. high and as broad; rays narrow, bright yellow, 8–10 mm. long and a little over 1 mm. wide; achenes hispidulous on the margins.

This species has been mistaken for *Senecio flavulus* Greene (*S. flavovirens* Rydb.). In fact, the type was included in the original publication of *S. flavovirens* and the characters of the achenes were drawn from it. The type of *S. flavovirens* is just in bloom and the achenes only slightly developed, but a closer investigation shows that they are perfectly glabrous. So are the young achenes of all the specimens cited under *S. flavovirens* except *Tweedy 586*. As this had well-developed achenes, I unfortunately described the achenes from it. The type of *S. flavovirens* and the other specimens cited under it, with the single exception mentioned, belong to *S. flavulus* Greene, described a few months earlier. Besides the difference in the achenes, *Tweedy 586* has longer and narrower rays and more deeply dissected stem-leaves than has *S. flavulus.* Since the publication of *S. flavovirens* we have received more specimens with long and narrow rays, but otherwise resembling closely *S. flavulus.* All these specimens have also hispidulous achenes.

WYOMING: Buffalo Fork, Aug. 1897, *Tweedy 586* (type, in herb. N. Y. Bot. Gard.); Snake River, Aug. 12, 1899, *Aven Nelson & Elias Nelson 6402*; headwaters of Clear Creek and Crazy Woman River, 1900, *Tweedy 3031;* low ground, Adams Ranch, Jackson's Hole, July 15, 1901, *Merrill & Wilcox, 967.*

MONTANA: Lima, June 30, 1895, *Shear 3409.*

The following species described from within the range of the New Manual or known to exist therein are not accounted for at all in that publication: *S. seridophyllus* Greene, *S. lanceolatus* T. &. G., *S. pereziifolius* Rydb., *S. neomexicanus* A. Gray, *S. laramiensis* A. Nels., *S. Hallii* Britton, *S. exaltatus* Nutt., *S. Scribneri* Rydb., *S. Porteri* Greene, *S. alpicola* Rydb., *S. turbinatus* Rydb., *S. pentadontus* Greene, *S. cognatus* Greene, and *S. Wardii* Greene.

Greene and Greenman regard *Senecio altus* Rydb. as a synonym of *S. sphaerocephalus* Greene, and I think that *S. perennans* A. Nels. is but a broad-leaved form of *S. werneriaefolius* A. Gray.

Blankinship in his Supplement to the Flora of Montana adopts *Senecio saxosus* Klatt, giving under it the synonyms: *S. petraeus* Klatt, *S. petrocallis* Greene, and *S. alpicola* Rydb. I can not find that *S. saxosus* Klatt was ever published. *S. petraeus* Klatt, or *S. petrocallis* Greene, is not found in Montana and *S. alpicola* is well distinct, being more closely related to *S. werneriaefolius* than to *S. petrocallis.*

TETRADYMIA

In the New Manual, *Tetradymia multicaulis* A. Nels. and *T. linearis* Rydb. are given as synonyms of *T. inermis* Nutt. The first I regard as a low depauperate form of *T. inermis*, but the second can not well be reduced to a synonym thereof. It is somewhat intermediate between *Tetradymia canescens* and *T. glabrata.* Except in the early spring it bears fasciculate leaves, as does *T.*

glabrata, but these leaves are more tomentose. The primary leaves are neither erect nor subulate and somewhat spine-like as they are in *T. glabrata*. It differs from *T. canescens* in the narrower, more or less falcate primary leaves and the presence of secondary fasciculate ones.

Tetradymia longispina (M. E. Jones) Rydb. comb. nov.

Tetradymia spinosa longispina M. E. Jones, Proc. Calif. Acad. Sci. II. **5**: 698. 1895.

This I think deserves specific rank.

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NEW YORK BOTANICAL GARDEN
BRONX PARK. NEW YORK CITY

CONTRIBUTIONS FROM THE NEW YORK BOTANICAL GARDEN—No. 138

NOTES ON ROSACEAE—IV

By PER AXEL RYDBERG

NEW YORK
1910

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL CLUB 37: 487–502. 28 O 1910

[From the BULLETIN OF THE TORREY BOTANICAL CLUB, 37: 487–502. 1910.]

Notes on Rosaceae — IV

PER AXEL RYDBERG

POTENTILLA (*continued*)*

PERMOLLES

This group contains only one species, *Potentilla permollis* Rydb. Dr. Wolf reduced this to a variety of *P. Blaschkeana*, evidently without having seen any specimen. It has a pubescence wholly unlike any species in the GRACILES or the NUTTALLIANAE groups, and although somewhat related to these, I regard it as distinct enough to be placed in a group by itself. Piper, who is rather conservative in his treatment, regards it as distinct in his Flora of Washington,† and cites three specimens.

CANDIDAE

This group contains six species, of which four are proposed as new. These are *Potentilla Elmeri*, *P. Pecten*, *P. subvillosa*, and *P. comosa*. Of these, the last one is related to *P. Bakeri*, and the rest to *P. candida*. *Potentilla Pecten* stands nearest to that species and differs mainly in the leaves, which are green above, and in the stem, which bears only a few small leaves. The following specimens belong to *P. Pecten:*

MONTANA: Bridger Mountains, 1897, *Rydberg & Bessey 4377*.

WYOMING: Cokerville, 1898, *Aven Nelson 4647;* Union Pass, *Aven Nelson 943*.

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*See Bull. Torrey Club **37**: 375–386.

†Contr. U. S. Nat. Herb. vol. 11.

UTAH: Big Cottonwood Cañon, 1905, *Garrett 1614.*

Potentilla Elmeri resembles *P. Pecten* in habit but is silky, not at all tomentose. It is represented by the following:

CALIFORNIA: Griffins, Ventura County, 1902, *Elmer 4009;* Donner Lake, 1903, *Heller.*

Potentilla subvillosa and *P. comosa* are very local and are represented by the type collections only.

Dr. Wolf in his monograph and Professor Aven Nelson in the New Manual of Botany of the Central Rocky Mountains unite *Potentilla Bakeri* and *P. viridescens*, and the former reduces both to a variety of *P. gracilis*. *P. viridescens* is evidently related to *P. gracilis* and differs in the characters presented by Dr. Wolf; but *P. Bakeri* has the leaves dissected to near the midrib into linear or linear-oblong and obtuse, not lanceolate and acute divisions. *P. Bakeri* has spreading pubescence on the stem, and the leaves are rather densely tomentose beneath. I have collected *Potentilla Bakeri* myself in Utah and *P. viridescens* in Montana and know that they both hold their characters well. Besides the specimens cited by me in the original publication, the following represent *P. Bakeri*:

UTAH: Wahsatch County, near Midway, 1905, *Carlton & Garrett 6721* and *6696;* Juab, June 10, 1902, *Goodding 1092;* Big Cottonwood Cañon, Aug. 14, 1905, *Garrett 1614;* Hot Pots, Wahsatch County, *Garrett F726.*

WYOMING: Chug Creek, Albany Co., June 29, 1900, *Aven Nelson 7318* (not *7317*, which is cited by Dr. Wolf under *P. gracilis viridescens*).

PECTINISECTAE

This group contains four species, of which *Potentilla longiloba* is described as new. It resembles *P. Blaschkeana* in habit, but the leaves are loosely villous-tomentose above. The following specimens belong here:

MONTANA: Lo Lo, May 29, 1897, *Elrod and assistants 110;* Gallatin Valley, near Bozeman, 1896, *Flodman 563*, in part.

WASHINGTON: Pullman, June, 1903, *Piper 4134.*

BRITISH COLUMBIA: Near international boundary between Kettle and Columbia rivers, June 25, 1902, *Macoun 63901.*

IDAHO: Clear Water, *Spaulding.*

Dr. Wolf regards *Potentilla ctenophora* as a variety of *P. flabelliformis*, which was also my first idea, before I knew the plant better. Dr. Wolf makes some remarks which read in translation as follows: "The relationship of this variety to var. *typica* seems to me about the same as, for instance, that of *P. argentea* var. *decumbens* to its var. *typica*, and its elevation to specific rank seems to have been made on slight grounds, as the author himself in his monograph says that it should perhaps be regarded as a variety of *P. flabelliformis*, as intermediate forms are not lacking. Why has he not let it remain in its original category? It seems that he makes the limitations of his idea of a species narrower as the years pass by." This may be in a certain sense true, but it has been brought about by a study of many years and the characters stand out better and better as the plants become better known. In this special case Dr. Wolf's remarks were more or less amiss. I do not know what specimens he might have had at hand to support his statements. Neither in the original descriptions of *P. flabelliformis ctenophora* in the Bulletin of the Torrey Botanical Club nor in my monograph, did I cite any specimens. Unfortunately, I forgot to do so. The illustration in the monograph gives only a basal leaf. There is nothing to show the differences in general habit and the flowers. Professor Piper has directed my attention to the fact that my *P. ctenophora* is the same as *P. Blaschkeana* Lehm. Later he has also recorded his views on this point in his Flora of Washington. I agree fully with Professor Piper and have stated before that my conception of *P. Blaschkeana* was a composite one, mainly made up of *P. grosse-serrata*. Dr. Wolf, I think, did not make the same mistake, for his description points unmistakably to *P. Blaschkeana* Turcz., as described and illustrated by Lehmann, not as characterized in my monograph. After the citation of Lehmann's plate, Dr. Wolf gives in parenthesis "(*optima*)". His conception of *P. Blaschkeana* was therefore evidently correct. As my *P. ctenophora* is evidently the same, why should it not be regarded as specifically distinct from *P. flabelliformis*?

Professor Aven Nelson in the New Manual of Botany of the Central Rocky Mountains makes *P. Blaschkeana* a synonym of *P. gracilis* and *P. ctenophora* a synonym of *P. flabelliformis*.

GRACILES

The following species were described as new in the North American Flora: *Potentilla intermittens*, *P. alaskana*, *P. dichroa*, and *P. camporum*.

As stated in the North American Flora, *Potentilla intermittens* may be a hybrid between *P. glaucophylla* and *P. filipes*, so intermediate is it in every respect that a mere glance would suggest its hybrid origin. As I had no direct evidence, however, I proposed a specific name and described it, hoping that botanists might study it further in the field. The following specimens belong here:

COLORADO: Cameron Pass, 1896, *Baker 25;* Buffalo Pass, 1898, *Shear 3863*.

ALBERTA: Foothills, 1897, *Macoun 16722*.

Potentilla alaskana resembles *P. viridescens* in habit but the flowers are much larger, the petals being 9–14 mm. long, the bractlets linear instead of lanceolate, and the leaves densely tomentose beneath. It differs from *P. gracilis* in the lower stem and the appressed pubescence on stems and petioles. Several specimens have been seen, but all were from the Island of Kadiak, Alaska.

Potentilla dichroa is related to *P. glomerata* but differs in the dense white tomentum of the lower surface of the leaves. It differs from *P. gracilis* in the thicker leaves, and in the stouter and lower, more leafy stem, which is appressed-hairy. The following specimens belong here:

MONTANA: Old Sentinel, 1901, *MacDougal 185*.

OREGON: Burns, 1901, *Griffiths & Morris 766*.

The following I have referred here, although they are less typical specimens:

UTAH: Hot Pots, Wahsatch County, 1905, *Garrett F727*.

NEVADA: Washoe Valley, *Stretch 74*.

Potentilla camporum is somewhat intermediate between *P. gracilis* and *P. filipes*, having the toothing of the leaves of the former and the small flowers of the latter. It has much broader, thicker, and more pubescent leaves than the former, more coarsely toothed and more hairy leaves than the latter. The following specimens are referred here:

SOUTH DAKOTA: Black Hills, *Miss Pratt 93*

MANITOBA: Rapid City, 1896, *Macoun 14447* and *14450;* Fort Ellis, 1906, *Macoun & Herriot 68930.*

SASKATCHEWAN: Milk River, 1881, *Dawson 34348;* The Holes, 1885, *Macoun 10447;* Cypress Hills, 1894, *Macoun 4538;* Herzel, 1906, *Macoun & Herriot 69827;* Park Bay, 1896, *Macoun 14447;* Silver City, 1885, *Macoun 635* and *7284.*

BRITISH COLUMBIA: Slotch-oot-a Lake, 1876, *Dawson 7282;* Nicola Valley, *Macoun 7229;* Revelstoke, 1890, *Macoun 7287.*

In 1901, while visiting northern Europe, I found in the Botanical Garden at Upsala specimens of *Potentilla pulcherrima* Lehm., which had been cultivated for several generations since Lehmann's time and kept unchanged the characters of pinnate leaves, etc. Side by side were growing also specimens of the so-called *P. gracilis* from Colorado with its digitate leaves. The latter is of course not the true *P. gracilis* but the *P. pulcherrima* of my monograph or *P. pulcherrima communis* Th. Wolf. Seeing these two forms together, the suggestion came to me that they might not be one species. While collecting in Utah, I found *P. pulcherrima* in the same cañon where Dr. Watson had rediscovered it, viz., in the Big Cottonwood Cañon, southeast of Salt Lake City. Here it was growing alone. Numerous specimens were seen in an open place along the river, but no digitate-leaved specimens were seen. I have come to the conclusion that it is not a parallel case to *P. diversifolia*, in which the basal leaves are either pinnate or digitate or both on the same plant. In all specimens of *P. pulcherrima* proper, the basal leaves are all pinnate, while in *P. pulcherrima communis* they are all digitate. In 1901, I described a supposed new species under the name of *P. filipes*, which Dr. Wolf reduced to a variety of *P. pulcherrima*. I have found that the characters separating *P. filipes* and the so-called *P. pulcherrima* of Colorado do not hold. I therefore united the two into one species under the name of *P. filipes* in the North American Flora. A depauperate high-mountain form of this species is *P. pulcherrima condensata* Th. Wolf.

Professor Nelson in the New Manual of Botany of the Central Rocky Mountains makes not only *P. pulcherrima* and *P. filipes* but also *P. fastigiata* and *P. Blaschkeana* synonyms of *P. gracilis*, a consolidation which goes altogether too far.

LONGIPEDUNCULATAE

This section contains only one species, which Dr. Wolf makes a doubtful variety of *P. gracilis.*

SUBJUGAE

This group also contains only a single species, *Potentilla subjuga.* In my monograph, I included also in this group *P. quinquefolia,* a disposition which Dr. Simmons in the Flora of Ellesmere Land rightly criticizes. This species I transferred in the North American Flora to the CONCINNAE group.

SUBCORIACEAE

This group contains three species, all Mexican. Dr. Wolf calls the group RANUNCULOIDES and includes in it not only these three species, and the BREVIFOLIAE and SUBVISCOSAE groups, but also such diverse plants as *Potentilla Townsendii, P. Palmeri, P. Ranunculus, P. flabellifolia, P. fragiformis,* and *P. Sierrae-Blancae,* together with *P. acuminata,* which is a species with pinnate leaves related to *P. saxosa.*

OBOVATIFOLIAE

This group also is Mexican and Central American and consists of three species. The first of these, *P. staminea* Rydb., was until lately known only from the type collection by Ghiesbrecht. It has been collected also in Guatemala, in 1896, *Seler 2753*. If I am not mistaken, they are the same specimens that Dr. Wolf cites under *P. haematochrus* on page 226 of his monograph. A few years after its publication I referred to this species doubtfully *Pringle 6890*. This evidently was the reason why Dr. Wolf reduced *P. staminea* to a variety of *P. leptopetala* Lehm. *Pringle 6890* is evidently much more closely related to *P. leptopetala* than to *P. staminea.* I have been inclined to refer *Pringle 6890* and other material collected later in the same region to *P. leptopetala,* for they agree fairly well with Lehmann's description (except as to the size of the petals). If, however, Lehmann's figure in his Monographia, *pl. 43,* is correct, then the plant from which it was drawn must be of a different species from *Pringle 6890* or else it is a freak or in an abnormal condition. I have seen neither the type of

P. leptopetala, nor the plants collected by Schiede and by Ehrenberg, enumerated in Linnaea. From certain remarks there I have suspected that these specimens belonged rather to the same species as *Pringle 6890* than to the typical *P. leptopetala*. Dr. Wolf, on page 228 of his monograph, also states that these specimens agree very well with *Pringle 6890*. From this I may judge that Dr. Wolf's interpretation of my *P. staminea* is wrong and that his *P. leptopetala staminea* is the same as my *P. obovatifolia*, which was based on *Pringle 6890*. Dr. Wolf has committed another grave blunder, for on page 251 he reduces *P. obovatifolia* to a variety of *P. concinnaeformis*. Here he also cites *Pringle 6890*, overlooking the fact that he had already cited the same number under *P. leptopetala staminea*. When preparing the manuscript for page 228, he evidently had the specimen before him, while when doing the same for page 251, he made use of no specimens and simply made *P. obovatifolia* a variety of *P. concinnaeformis*, because of my statement that it was nearest *P. concinnaeformis* of the CONCINNAE group. From his treatment of *P. concinnaeformis*, it is evident that Dr. Wolf had seen no specimens of that species. All he had to go by was the short description and plate in my monograph. I think it rather audacious to reduce one species to a variety of another, without knowing material of either. The following specimens belong to *P. obovatifolia*:

MEXICO: Sierra de Pachuca, Hidalgo, 1898, *Pringle 6890;* also in 1902, *Pringle 9783;* Cuyamaloya, Hidalgo, 1906, *Pringle 10276*.

HORRIDAE

This group contains two Mexican species, known only from the type collections. *Potentilla horrida* is referred to the HAEMATOCHROAE group by Dr. Wolf, notwithstanding its yellow flowers. *P. durangensis* is described as new in the North American Flora.

RUBRAE

The oldest known species of this group is *Potentilla comarioides* Humb. & Bonp. Unfortunately this universally known name is antedated by one year by *P. rubra* Willd., which name must be adopted. The group contains seven species from northern Mexico and the southwestern United States. Of these, *P.*

madrensis is overlooked by Dr. Wolf. *P. sanguinea* is described as new in the North American Flora.

AUREAE

As treated in the North American Flora, this group contains nine North American species. If one follows Dr. Wolf in laying so much stress on the form of the style, all the American species, except *Potentilla maculata* and *P. Langeana*, should be excluded from the AUREAE group. In this group the styles should be somewhat thickened upward, instead of downward. In some species the styles are perfectly filiform, not thickened either way. The result is that a distinct line can not be drawn between the CONOSTYLAE and the GOMPHOSTYLAE of Dr. Wolf's monograph. In the AUREAE, Dr. Wolf has such diverse species as *Potentilla maculata*, *P. elegans*, *P. Robbinsiana*, and *P. gelida*. Of these, *P. Robbinsiana* at least does not have the styles thickened upwards. The RANUNCULOIDES group of Dr. Wolf is still worse. It contains not only the thick-leaved and thick-rhizomed Mexican and Central American species, of which it was made up in my treatment, and my SUBVISCOSAE and BREVIFOLIAE groups, but also such diverse species as *Potentilla acuminata* Hall (related to *P. saxosa*), *P. flabellifolia* Hook., *P. fragiformis* Willd., *P. Townsendii* Rydb., *P. Palmeri* Th. Wolf, and *P. Sierrae-Blancae* Rydb. *Potentilla emarginata* Pursh is placed with the AUREAE, while the closely related *P. fragiformis* is placed in RANUNCULOIDES. *P. gelida* Mey. is put in the former, and *P. flabelliformis* Hook., which S. Watson and other students of *Potentilla* have not been able to distinguish from it, is put in the latter group; *P. perdissecta* Rydb. or, as Dr. Wolf calls it, *P. diversifolia* var. *decurrens* (Wats.) Th. Wolf, is placed in the MULTIJUGAE, while *P. Ranunculus* Lange, which can be separated from it only by the different rootstock (see below), is placed in the RANUNCULOIDES. *P. Townsendii* and *P. Palmeri* and their relationship I have discussed before. Dr. Wolf's grouping in this case therefore is very artificial and unsatisfactory.

I think that the group as constituted by me is more natural, although it could be subdivided into three subgroups. *Potentilla Sierrae-Blancae* stands alone, is not so closely related to the rest, and shows many affinities to the CONCINNAE, although it lacks tomentum.

Potentilla maculata and *P. Langeana* are closely related. Dr. Wolf adopts the name *P. alpestris* for the former, claiming that the name *P. maculata* Pourr. probably belongs to *P. pyrenaica* Ram. He does not, however, adopt the name *P. maculata* for the latter, although the name is much older. Dr. Wolf does not admit *P. Langeana* as a distinct species.

The rest of my AUREAE group are closely related. *Potentilla Vreelandii* Rydb. was first described in the North American Flora, and was consequently unknown to Dr. Wolf.

Potentilla diversifolia Lehm. is placed in the MULTIJUGAE group by Dr. Wolf, and under it he recognizes four varieties: *genuina*, *decurrens*, *glaucophylla*, and *jucunda*. It is true that *P. diversifolia* often has at least some of the leaves pinnate, although with closely approximate pairs of leaflets, and that it connects the MULTIJUGAE and the AUREAE groups. The forms regarded as varieties of it by Dr. Wolf have digitate leaves.

Concerning *Potentilla glaucophylla* Lehm., first described as a species and afterwards reduced to a variety of *P. diversifolia* by the author himself, it may be said that although it is very close to some forms of *P. diversifolia*, especially when they bear only digitate leaves, it seems to be more different in the living state than in dried material, and Professor Aven Nelson,* who also has had chance to study them in the field agrees with me in regarding them as distinct.

That Dr. Wolf reduced *Potentilla jucunda* to a variety is probably due to the fact that he had received unusually large specimens of *P. glaucophylla* which were labeled *P. jucunda*. See the remarks in my preceding Notes on Rosaceae.

What I actually described and figured in my monograph of *Potentilla* as *Potentilla decurrens*, was not the same as *P. dissecta decurrens* of S. Watson. My description was, however, made broad enough to include Watson's plant. In 1905, while collecting in Utah, I collected at several places a plant which I regarded as a new species. A closer comparison with Watson's type of *P. dissecta decurrens* (which is a rather poor specimen) revealed my mistake. *Potentilla decurrens* of my monograph, and as understood by A. Nelson, *loc. cit.*, or *A. diversifolia* var. *decurrens* Th. Wolf, mainly, is not the same as Watson's plant. It is a plant related to *P. glaucophylla* and *P. Ranunculus*, while the original *P. dissecta decurrens* is related to *P. ovina* J. M. Macoun. In the North American Flora, the former is described under the name *P. perdissecta*.

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*See Coult. & Nels. New Man. Cent. Rocky Mts. 257.

Potentilla Ranunculus Lange, which Dr. Wolf associates with *P. ranunculoides* H. B. K., is not related to that species but to the one just discussed above and to *P. glaucophylla*. It is hard to distinguish it from these species except by the rootstock, which in *P. Ranunculus* is much branched and creeping and densely covered with scales. This character is found in many arctic plants and is perhaps due to the climatic conditions. *P. Ranunculus* has usually broader leaflets than *P. glaucophylla* and they are less dissected than in *P. perdissecta*.

Potentilla multisecta (S. Wats.) Rydb. is closely related to *P. perdissecta*. Dr. Wolf reduces it back to a variety of *P. dissecta*, as it was originally described by S. Watson. This is really a transfer to another species, for *P. dissecta* of Watson was not the same as *P. dissecta* Pursh, but was *P. diversifolia* Lehm. This transfer is made, although Dr. Wolf expressly states that he has not seen *P. dissecta* Pursh. Professor Nelson, *loc. cit.*, has omitted this species, although it has been collected in Wyoming.

SUBVISCOSAE

Very little can be said about this group, as little material has been received since my monograph and few new facts have been brought to light since that time. Through further study of *Potentilla Wheeleri viscidula*, I have come to the conclusion that it deserves specific rank and it is given such in the North American Flora. Dr. Wolf has made no change in the species of this group, as he had seen specimens of only *P. Wheeleri*. As stated before, he includes the whole group in his RANUNCULOIDES.

CONCINNAE

This group has been a little modified from the treatment in my monograph and a few species have been transferred from other groups.

Potentilla fastigiata Nutt. was transferred from the GRACILES group. Although it connects the CONCINNAE with this group and with the CANDIDAE, and has a more erect stem than the other species, I think, after all, that it should be placed here and that it has its nearest relative in *P. concinnaeformis* Rydb. Dr. Wolf retains it in the GRACILES group and associates it with *P. tomentosa*, *P. oaxacana*, and *P. Nuttallii*. Its nearest relative outside the CONCINNAE is *P. candida* Rydb., and a few of the specimens cited by me under the latter in my monograph belong to *P. fastigiata* instead. It is evidently unknown to Professor Nelson, for under *P. gracilis*, he has the following remark: "(This may be a composite species; as here used it includes the following, which are not readily discriminated: *P. fastigiata* Nutt.; *P. pulcherrima* Lehm.; *P. Blaschkeana* Turcz. . . . .)" The leaves of *P. fastigiata* are silky-villous with rather long hairs on both sides, only very slightly tomentose beneath.

A species related to this and *P. concinnaeformis* is described in the North American Flora under the name of *Potentilla Hassei*. It differs from *P. fastigiata* in the broader, broadly obovate leaflets and the oblong instead of linear-lanceolate bractlets, and from *P. concinnaeformis* in the dense many-flowered inflorescence, the densely pubescent stem, and the oblong bractlets. Besides the type given in the North American Flora, I have seen the following specimens, referable to it:

CALIFORNIA: Head of Stanislaus River, 1903, *Hall & Chandler 4778*.

There has been no change made in *Potentilla concinnaeformis*, *P. oblanceolata*, and *P. bicrenata* since my monograph, except that the range of the last one has been extended to Wyoming, where it has been collected by Professor Nelson. Dr. Wolf admits all three as species, although he had not seen specimens of any of them. Concerning the reduction of *P. obovatifolia* Rydb. to a variety of the first one, see my remarks on page 493.

A further study of *P. concinna* and its variety *divisa* brought to light facts that seemed to me sufficient to warrant the raising of the latter to specific rank.

In the North American Flora, I transfer *Potentilla quinquefolia* Rydb. to this group. In my monograph I had placed it with *P*.

subjuga. My placing it with that species was done simply because both show a tendency to combining digitate and pinnate characters in the leaves. Dr. Simmons in the Flora of Ellesmereland, has rightly criticized me for so doing. The species was based upon *Potentilla nivea pentaphylla* Lehm., as represented by some of the specimens cited in Hooker's Flora Boreali-Americana. Unfortunately Dr. Lehmann did not propose the name in the work just mentioned, although he gave a description. His publication of the variety did not appear until 1850.* In the meantime, the name had been taken up by Turczaninow,† but whether for the same plant or not I can not tell. As the name *pentaphylla* was not available I used another name, *P. quinquefolia*, and it matters little what plant Turczaninow had, as *P. quinquefolia* applies to the North American plant characterized in my description. In 1900 Mr. Morten Pedersen Porsild sent me a collection of Potentillas from Greenland. I undertook to determine them and also published a paper upon them in the Bulletin of the Torrey Botanical Club for March, 1901. Some of the work was hastily done and several corrections to that paper must be made. One of the mistakes made was that I regarded *P. nivea subquinata* Lange as identical with *P. quinquefolia*. Following the Madison amendments to the Rochester Code, I substituted the name *P. subquinata* (Lange) Rydb. for *P. quinquefolia*. *P. nivea*, as well as other 3-foliolate species, has occasionally some of the lower leaves 5-foliolate, but *P. quinquefolia* has them nearly always so. On account of this confusion, I have been severely criticized both by Dr. Simmons and by Dr. Wolf for regarding *P. quinquefolia* Rydb. as a distinct species. The former made the following remarks: "there being not the slightest cause to look upon it as a species as Rydberg has done, probably because he has had no opportunity of studying the plant from nature." If Dr. Simmons had taken a little trouble, he could have found that this statement was not exactly true, for in my monograph, I cited a specimen collected by myself in Montana, viz., *Rydberg & Bessey 4397*, and I had had opportunity to study it in the field. I have since collected it at two other stations, one in Colorado and one in Utah.

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*Delect. Sem. Hort. Hamb. **1850**: 12. 1850.

†Bull. Soc. Nat. Mosc. **14**: 607. 1843.

In neither case did I find a single specimen that could be referred to *P. nivea*. At the Colorado station it was associated with *P. saximontana* and *P. uniflora*, but was easy to distinguish, especially from the latter. In the collections at the New York Botanical Garden there are eighteen sheets of *P. quinquefolia*, representing sixteen localities. I have seen perhaps as many more localities represented in other herbaria, and have seen no sheets on which it was mixed with *P. nivea* proper. We have only four sheets of *P. nivea* from the Rocky Mountain region. When I visited Copenhagen in 1901, I confused *P. rubricaulis* with it and named a specimen of the latter *P. subquinata*. This was due mostly to the fact that I had a wrong idea of *P. rubricaulis* Lehm. and had applied the latter name to what appears in the North American Flora as *P. rubripes* Rydb. Dr. Simmons has cleared up *P. rubricaulis* Lehm. in such a way that nothing more needs to be said, except perhaps that he could have made plainer the differences between the trifoliolate *P. rubricaulis* var. *arctica* and *P. nivea* L., taken in such a broad sense as Dr. Simmons has done. Of the specimens collected by Pedersen and referred to *P. subquinata* by me, *no. 496*, as represented in the New York Botanical Garden herbarium, is a form of *P. nivea* L., with some quinate leaves. It is intermediate between *P. nivea macrophylla* and *P. nivea subquinata*. *Nos. 113* and *233* belong to *P. nipharga* Rydb., which also sometimes has quinate leaves. The other numbers are not represented here. There is none referable to *P. quinquefolia*, which seems confined to the Rocky Mountains of the United States and Northwestern Canada.

Closely related to *P. quinquefolia*, perhaps a depauperate variety thereof, is *P. modesta* Rydb., described as new in the North American Flora. It is confined to two mountain chains in Utah. It differs from *P. quinquefolia*, besides in the smaller stature, in the linear and obtuse instead of lanceolate and acute bractlets, the golden yellow petals only 4 mm. long, and the dense inflorescence, reminding one of that of *P. Hookeriana*. The following specimens belong to it:

UTAH: Mount Barrette, July 26, 1905, *Rydberg & Carlton 7261, 7259*, and *7258;* Sierra La Sal, 1899, *C. A. Purpus G, Q*, and *R*.

NIVEAE

This group is represented in the North American Flora by nine species. Of these, two are proposed as new, *P. nipharga* and *P. Pedersenii*, the first based on specimens referred to *P. nivea* and several of its varieties, the latter based on *P. subquinata Pedersenii* Rydb.

Dr. Simmons in his Flora of Ellesmere Land remarked: "Rather might it be justifiable to distinguish all the arctic forms with deeply incised leaflets, from the typical *P. nivea*, which has them more rounded and feebler dentate. I have, however, had too little opportunity to study them from nature, to be able to give any definite opinion about it. . . . Rydberg has, however, not only established a new species *P. quinquefolia* for the plant here in question, but . . . ." If we compare this quotation with the other one from the same discussion given above we notice that Dr. Simmons contradicts himself. In the first quotation he states "there being not the slightest cause to look upon it as a species" and in the latter "rather might it be justifiable to distinguish all the arctic forms. . . ." These arctic forms with deeply incised leaflets, certainly look very different from *P. nivea* proper, but at the same time they are not the same as my *P. quinquefolia*. As I could not find any available name for them I proposed *P. nipharga* in the North American Flora. The plant is not exclusively arctic, for similar specimens, although usually smaller, have been collected in the Rockies, especially in Utah. Some of the specimens included in *P. nivea dissecta* by S. Watson belong here, others belong to *P. divisa* Rydb. The name *dissecta* is, however, not available. *Potentilla nivea subquinata* Lange is probably a form of this with some quinate leaves, but as the name *P. subquinata* has been applied to another species, it is not available for this. It includes probably *P. nivea arenosa* Lange, but it is not *P. nivea arenosa* Turcz. I think that it is *P. nivea pinnatifida* Lange (not that of Lehmann), but *pinnatifida* can not be used as a specific name for it. It is the same as *P. nivea altaica* Rydb., at least as far as the Utah specimens are concerned. I thought that it was the same as *P. altaica* Bunge, but have seen my mistake. I agree fully with the opinion of Dr. Simmons that "it [*P. altaica*] does not belong to *P. nivea*," not even if *P. quinquefolia*, *P. ni-*

pharga, and *P. uniflora* are included. Dr. Simmons states further: "In the Index Kewensis, it is referred to *P. multifida* L., where its right place seems rather to be." This statement was made after Dr. Simmons had seen the original specimens of Bunge. It is not unlikely at all that its relationship is with *P. pinnatifida*, but the plate illustrating it does not resemble so much *P. pinnatifida* as *P. Hookeriana*. The latter is also intermediate between the NIVEAE and the MULTIFIDAE groups, both in habit, the congested inflorescence, and the fusiform style. I can not agree with Dr. Wolf in regarding *P. altaica* as merely a form of *P. nivea pinnatifida* in the sense he uses the name. I refer the following specimens to *P. nipharga*:

MACKENZIE: Fort Good Hope, 1861–2, *I. S. Onion* (type).

ALBERTA: Rocky Mountains, *Drummond 368*.

UTAH: Sierra La Sal, 1899, *C. A. Purpus A, C, L*, and *H*.

GREENLAND: Vajat-shore, Disco, *Morten Pedersen 113;* Unartuarsuk, Disco, *Morten Pedersen;* Onjigsak, Disco, *Morten Pedersen 233*.

Potentilla Pedersenii Rydb. was based upon *P. subquinata Pedersenii* Rydb. In describing the latter I had only one collection in flower, viz., *Morten Pedersen 470*, and the description was drawn wholly from that. Laying too much stress upon the peculiar rootstock of this species and almost overlooking more essential characters, I referred carelessly to it several sterile specimens with a similar rootstock. These do not belong to it and Dr. Wolf is fully correct in his criticism of me for basing the variety on a mixture and for including in it specimens which he refers to *P. nivea* and var. *subquinata*. The type specimen he regards as a small-flowered *P. Wahliana*. With this I can not agree. It is true that it has something of the habit of *P. Wahliana*, the long hairs, although not yellowish, of that species, and the pubescent upper surface of the leaves; but it does not have the large, broad, and overlapping petals of *P. Wahliana*, or the oval or elliptic obtusish bractlets characteristic of that species and *P. villosa*. It has the flowers of *Potentilla nivea*. It could be a hybrid of *P. nivea* and *P. Wahliana*.

Dr. Wolf regards both *P. uniflora* and *P. Hookeriana* as varieties of *P. nivea*. *P. Hookeriana*, at least, is very distinct, and were it not for the 3-foliolate leaves, I would associate it with the MULTIFIDAE group, especially with *P. pseudosericea* and *P. paucijuga*. The style is just as fusiform as in those species and the inflorescence is compact as in that group, not open as in the typical species of the NIVEAE.

Dr. Wolf also regards *P. prostrata* as a variety of *P. nivea*, in this respect following Dr. Lehmann, but neither Lehmann nor Wolf seems to have seen the type of *P. prostrata* Rottboell. Dr. Wolf refers to it a specimen collected by Morten Pedersen, labeled as *P. quinquefolia* Rydb., but according to Wolf, better referable to *P. nivea macrophylla*. It is probably *Pedersen 496* that is referred to, but this has nothing to do with *P. prostrata* Rottb. The type of the latter is in the herbarium of the Botanical Garden at Copenhagen, where I saw it in 1901 and drew from it the description which is found in the North American Flora. I have seen no other specimen resembling it, and no form of *P. nivea* or of any of the species often included in it approaches it. The leaflets resemble those of *P. gracilis* but are three in number, and the flower and inflorescence are different.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

CONTRIBUTIONS FROM THE NEW YORK BOTANICAL GARDEN—No. 139

ADDITIONS TO THE FLORA OF PENINSULAR FLORIDA

By JOHN K. SMALL

NEW YORK
1911

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL CLUB 36: 159-164, Ma 1909 and 37: 513-518, O 1910.

[From the BULLETIN OF THE TORREY BOTANICAL CLUB 36: 159-164. 1909.]

Additions to the flora of peninsular Florida

I. NATIVE SPECIES

JOHN K. SMALL

The species enumerated below are for the most part additions to the hitherto known flora of the United States. They are all new to the mainland and only five of them were heretofore known as members of the flora of the United States from specimens collected on the Florida Keys.

With one or two exceptions, these additions were brought to notice by exploration carried on by the New York Botanical Garden, and the type specimens of the species here described for the first time are preserved in its herbarium.

Thysanella robusta sp. nov.

Plants mainly 6–9 dm. tall, often somewhat spreading, much stouter than those of *T. fimbriata:* leaves 3–6 cm. long, ascending; blades linear, acute, striate-nerved; ocreae imbricate on the lower part of the stem, mostly separated above, copiously fringed: racemes mainly 4–7 cm. long, 8–10 mm. thick, the ocrealae closely imbricate, each terminating in an elongate pale tip: calyx white, often becoming pink; the outer sepals entire or irregularly cleft, the inner ones becoming 3.5 mm. long: filaments about 4 mm. long: achenes fully 2 mm. long and fully 1.5 mm. wide, long-beaked.

A species hitherto confused with *Thysanella fimbriata.* It differs from that species by its much greater size, the larger sepals and achenes. Specimens collected at Braidentown, Florida, August 28, 1901 (*Tracy 7638*), may constitute the type.

Other recently collected specimens belonging to this species are: Jensen, March 25, 1897, *Curtiss 5837.* Dade County, November & December, 1903, *Eaton 776.*

Warea Carteri sp. nov.

Annual, glabrous, bright green: stems erect, 4–15 dm. tall, simple or widely branched above, mostly purple-tinged below, terete: leaves alternate; blades linear or sometimes cuneate, especially on the lower part of the stem, 1.5–3.5 cm. long, abruptly pointed or mucronate, often slightly veiny: racemes many-flowered, the rachis becoming 12–20 mm. long: pedicels becoming 9–12 mm. long:. sepals 4.5–5.5 mm. long, nearly linear to somewhat spatulate: petals white or nearly so, 6–8 mm. long, the claws prominently sharp-toothed, the blades orbicular to reniform, undulate: stamens 7–8 mm. long, the anthers about ⅓ as long as the filaments: ovary-body about as long as the stipe: pod-bodies 5–6 mm. long, curved, terminating the stipe, which becomes 6–7 mm. long.

Named for Mr. J. J. Carter, of Pleasant Grove, Pennsylvania, who has been associated with the writer in the exploration of South Florida.

This, apparently the most common species of *Warea*, occurs in great abundance, especially in southern peninsular Florida. Specimens belonging here have hitherto been confused with *Warea cuneifolia* (Muhl.) Nutt. *Warea Carteri* differs from *W. cuneifolia* in its narrower sepals, white corolla, suborbicular or reniform petal-blades, longer stipitate ovary, shorter pedicels, longer pod-body and shorter mature stipe. The type specimens were collected in pinelands between Cutler and Black Point, Florida, November, 1903 (*Small & Carter 831*). Other specimens belonging here are as follows:

Miami, November, 1878, *Garber 26;* October and November, 1903, *Small & Carter 511.* Indian River region, September, *Curtiss 171.*

Cracca corallicola sp. nov.

Perennial, densely pale-hairy all over, the branches, peduncles and petioles short-hirsute: stem erect, 4–19 dm. tall, densely branched, the branches decidedly zigzag, rather rigid: leaves numerous, 4–11 cm. long; leaflets 11–15, 9–31 mm. long, the blades linear to linear-oblong, mucronate, prominently ribbed, copiously pubescent: stipules quite persistent, 1–3 mm. long: racemes several-flowered, borne on short peduncles: pedicels stout, becoming 2–3.5 mm. long: calyx permanently hirsute; tube broadly campanulate; lobes subulate above the broader bases, the lower ones nearly as long as the tube: corolla pinkish or purplish; standard 7–11 mm. long; blades orbicular or obovate-orbiculate; wings 6–7 mm. long; keel shorter than the wing-petals: pods 3.5–4.5 cm. long, about 3 mm. wide, finely pubescent: seeds fully 3 mm. long.

This species differs from *Cracca cinerea* L. by its pubescence, the shape of the blades of the leaflets, the smaller corolla and the short calyx-lobes. The type specimens were collected in pinelands between Cocoanut Grove and Cutler, November, 1904 (*Small 2112*).

SWIETENIA MAHAGONI Jacq.

As a member of the flora of the United States, the mahogany has heretofore been confined to the Florida keys. Its range may now be extended to the mainland, where it was found growing on the Everglade Keys in the large hammock south of Miami in November, 1904 (*Small 2272.*)

CAPERONIA CASTANAEFOLIA (L.) St. Hil.

This West Indian plant was discovered growing on Long Key (Everglades) in January, 1909 (*Small & Carter 2832*).

CHAMAESYCE BLODGETTII (Engelm.) Small

Hitherto this species has been known only from the lower Florida keys and the Bahamas. Several years ago it was discovered on the mainland, growing plentifully in open hammocks back of Black Point below the settlement of Cutler (*Small & Carter 823*).

COLUBRINA RECLINATA (L'Her.) Brongn.

The tree was found on the Everglade Keys, growing in hammocks southwest of the settlement of Perrine in November, 1904 (*Small 2249a*).

PASSIFLORA PALLENS Poepp.

Specimens matching C. Wright's Cuban specimens numbered 2599 were collected from plants growing on the edges of several hammocks in the homestead country southwest of Cutler. The species was first discovered in Florida near Camp Longview by Mr. P. Wilson and the writer (*no. 1740*) and later by the writer on the Caldwell and adjoining homesteads (*no. 2143, 2557 & 2559*). The plants are remarkable on account of their large stipules, and in this respect they resemble those of the South American *Passiflora stipulata* Aubl.

SOLANUM BLODGETTII Chapm.

Previous to the year 1904 this species was known only from Key West. During the past few years it has been collected both on the mainland of Florida and on the Bahamas. The following citations represent specimens from peninsular Florida. They are all from the Everglade Keys and vicinity.

Everglades near Camp Jackson, *Britton 237*. Hammocks, Long Key, *Small & Wilson 1678*. Everglades west of Camp Jackson, *Small & Wilson 1962*. Everglades between Homestead and Cross Key, *Small & Carter 2675*.

BOURRERIA VIRGATA (Sw.) G. Don

The shrub or small tree was recently discovered growing on an outlying Everglade Key situated about eight miles below the settlement of Cutler (*Small & Carter 2818*).

Goniostachyum citrosum sp. nov.

A straggling or reclining shrub with elongate and irregularly branched stems, the bark pale-gray or whitish, the branches strigillose: leaves opposite; blades lanceolate to elliptic-lanceolate, 2.5–6 cm. long, acuminate, shallowly serrate, pubescent on both sides, pale beneath, dark green above, narrowed to petiole-like bases: peduncles solitary in the axils, 5–16 mm. long, strigillose: spikes depressed, 4–6 mm. long; bracts ovate, acute or acuminate, the outer ones 4–5 mm. long: calyx about 1 mm. long; lobes broadly triangular, much shorter than the tube: corolla white about 4.5 mm. long, minutely pubescent; tube swollen above the middle; limb about 3 mm. broad: nutlets 1.5 mm. long.

This species differs from *Goniostachyum graveolens* by its strigillose foliage, its sparingly and shallowly serrate acuminate leaf-blades and its short spikes. The type specimens were collected in the hammocks near the Silver Palm Schoolhouse southwest of Perrine, November, 1904 (*Small 2142*). Collected in 1906 in the same region (*Small & Carter 2680*).

This plant was first collected in Mexico many years ago; but these specimens were referred to *Lantana canescens* H. B. K., a species originally from northern South America. The species was discovered in Cuba the same year that it was first found in Florida. Its geographical distribution seems to be the same as that of *Alvaradoa amorphoides* Liebm., with which it is associated in the hammocks in Florida.

Phyla stoechadifolia (L.) comb. nov.

Verbena stoechadifolia L. Sp. Pl. 19. 1753.

Lippia stoechadifolia H. B. K., Nov. Sp. & Gen. Pl. **2**: 265. 1817.

Recent exploration on Long Key (Everglades) brought this verbenaceous plant to light as a member of the flora of the United States (*Small & Carter 2863*). On certain portions of the largest island of the group the plants grew in great abundance.

LANTANA OVATIFOLIA Britton

This species described from plants collected on the Bahamas is common in southern peninsular Florida. The collections cited below belong to this species:

Punta Rassa, *Hitchcock 268*.
Bull Key, opposite Lemon City, *Small & Carter 618*.
Ft. Lauderdale, *Small & Wilson 1747*.
Between Homestead and Camp Jackson, *Small & Wilson 1877*.
Beach opposite Miami, *Small 2101*.
Palm Beach, *Small 2134*.

GERARDIA DOMINGENSIS Spreng.

This West Indian *Gerardia* was found growing in great abundance in the low pinelands about Camp Longview and in the adjacent everglades during the spring of 1904 (*Small & Wilson 1570 & 2008*).

SPERMACOCE ASPERA Aubl.

Plants belonging to this species were found growing in abundance in hammocks between Cocoanut Grove and Culter, Florida, by Mr. J. J. Carter and the writer in November (*no. 1207*).

DIODIA RIGIDA Cham. & Schlecht.

The pinelands between the settlement of Cutler and Black Point Creek contain many large areas of this tropical American plant. Luxuriant plants were collected there in November, 1906 (*Small & Carter 2706*).

PHORADENDRON RUBRUM (L.) Krug & Urban

The discovery of this species in peninsular Florida adds another parasitic plant to our flora. Flowering specimens were collected at Deep Lake, Florida, March 7, 1905, by Mr. A. A. Eaton (*no. 1310*).

Melanthera radiata sp. nov.

Stems several or many from a thick root, radially spreading, decumbent, 2–4 dm. long, simple or sparingly branched, sparingly appressed-pubescent: leaves opposite; blades ovate in outline, 1–4 cm. long, more or less distinctly hastate-lobed and irregularly toothed, rough-pubescent, short-petioled: heads long-peduncled: involucres not foliaceous; bracts ovate to oblong-ovate, not surpassing the disk, the outer ones 6–7 mm. long, ciliate and pubescent: bractlets 6–7 mm. long, ciliate at the tips: corollas 6.5–8 mm. long; tube sparingly pubescent above; lobes ovate, ciliate: achenes 2.5–3 mm. long, slightly broadened upward, very minutely papillose, with a prominent tip over each side: pappus-bristles deciduous, longer than the achene.

Melanthera radiata is most closely related to *M. aspera* (Jacq.) Steud. (*M. deltoidea* Michx.) from which, however, it differs conspicuously in habit, the several or many stems arising from a thick, woody root, spreading radially, and decumbent. The leaf-blades too are small and very short-petioled and with sharp teeth. The type specimens were collected in pinelands near the homestead trail near Camp Longview, Florida, May 13–16, 1904 (*Small & Wilson 1575*).

From the Bulletin of the Torrey Botanical Club 37: 513-518. 1910

Additions to the flora of peninsular Florida

II. NATURALIZED SPECIES

John K. Small

The plants recorded in the following list represent species chiefly new to the hitherto known flora of the United States. Two of the species have been established on the Florida Keys for many years, and two have been collected in other parts of the United States. The others have been brought into peninsular Florida from many foreign countries and only recently established themselves as members of our naturalized flora. The specimens were for the most part secured through explorations in Florida maintained by the New York Botanical Garden.

Cyperus alternifolius L.

It was a surprise to find this African plant established in the Everglades. In company with Mr. J. J. Carter, I discovered it growing in the front prairie at a point about five miles south of Black Point Creek and two miles east of Naranja. The plant was evidently carried there through the agency of animals. Specimens were collected on January 14, 1909, *Small & Carter 2911.*

Rhoeo discolor (L'Her.) Hance

This species, commonly cultivated in Florida, has begun to establish itself beyond the limits of the gardens, and should now be recognized as a member of our wild flora.

The writer collected specimens in pinelands about Miami in November, 1904, *Small 2295*, while Mr. A. A. Eaton discovered naturally self-supporting plants at Chatham Bay, on the opposite side of the state, in the spring of 1905.

Aneilema nudiflorum R. Br.

This East Indian plant is now thoroughly established about Braidentown, Florida, and is said to be spreading rapidly. Mr. J. H. Simpson has had it under observation for several years past and reports that it has now become a permanent member of the flora of this continent.

ZEBRINA PENDULA Sch.

A copious growth of this species was discovered in the heart of a dense hammock near the beach south of Palm Beach, Florida, in November, 1904, *Small 2168*. If the species is not indigenous it was doubtless carried to where I found it by birds or by other animals.

ANANAS ANANAS (L.) Lyons

The pineapple has become spontaneous on the mainland as well as on the Florida Keys, particularly in abandoned fields and adjacent pine'ands.

SANSEVIERA GUINEENSIS Willd.

This African plant, now widely cultivated in the tropics, is naturalized in peninsular Florida, and Dr. Britton also found it growing in waste places in Key West in the spring of 1903.

MUSA SAPIENTUM L.

The common banana has established itself in low hammocks near Miami. It is abundant between Cocoanut Grove and Cutler, and thrives particularly well in Snapper Hammock. Specimens were collected there in November, 1904, *Small 2254*.

MUSA CAVENDISHII Lamb.

The dwarf banana, now widely cultivated in southern Florida, is also naturalized. It is not uncommon in waste and abandoned grounds about Miami, and I have observed it at points farther north along the east coast. Specimens were collected in Snapper Hammock between Cocoanut Grove and Cutler in November, 1904, *Small 2251*.

ALPINA SPECIOSA (Wendl.) Schum.

Recent exploration in the Everglades has discovered this East Indian plant as a naturalized member of our flora. Mr. J. J. Carter and the writer found the plants established in hammocks between Perrine and Cutler on November 16, 1906, *no. 2469*.

ACHYRANTHES ASPERA L.

This tropical American plant was found in the Brickel Hammock near Miami on February 20, 1905, by Mr. A. A. Eaton (*no. 1188*). This collection adds a second species of the genus *Achyranthes* to our flora. *Achyranthes obtusifolia* was collected on Key West several years before.

GOMPHRENA DECUMBENS Jacq.

A native of Mexico, or perhaps of Texas and Mexico, this relative of the Bachelors Button, *Gomphrena globosa*, has been introduced into other countries chiefly through its cultivation in gardens. As early as 1897 Mr. N. K. Berg collected specimens at Tampa, and in 1903 Dr. Britton collected specimens in the same region, *no. 80*.

CLITORIA TERNATEA L.

This plant, originally from the East Indies, but now widely dispersed through the tropics, has escaped from cultivation in Florida. Specimens were collected by the writer in pinelands between Cocoanut Grove and Cutler in November, 1904, *no. 2225*.

CAJAN CAJAN (L.) Pollard

Within the last few years this species has escaped from cultivation and established itself in several localities in the vicinity of Miami. Collections were recently made as follows:

Pinelands between Cocoanut Grove and Cutler, *Small 2229*.
Pinelands about Arch Creek, *Small 2305*.

DOLICHOS LABLAB L.

The hyacinth bean, grown in Florida both as an ornamental and an esculent plant, has become established as a member of our flora. Specimens were collected by the writer about Miami in November, 1904.

PHASEOLUS VULGARIS L.

The common bean has established itself in southern Florida. It occurs not only in waste grounds, but also in the pinelands remote from settlements or other human habitations. Its occurrence in the pinelands may be accounted for by the former existence of camps. Specimens were collected in pinelands between Cocoanut Grove and Cutler in the fall of 1903, *Small & Carter 1280.*

PHASEOLUS LUNATUS L.

The Lima bean became naturalized in Florida under the same conditions as the *Phaseolus vulgaris.* Specimens were collected on hammock islands between Homestead and Cross Key in the fall of 1906, *Small & Carter 2572.* The plant occurs under nearly similar conditions on Andros, Bahamas.

CICCA DISTICHA L.

This native of the East Indies, known as the Otaheite gooseberry, now widely cultivated in the tropics, has escaped from cultivation in South Florida, where it is grown for its fruits, which are used as a substitute for gooseberries. Specimens were collected in pinelands near Miami in November, 1904, *Small 2227.*

Breynia nivosa (W. G. Smith) Small, comb. nov.

Phyllanthus nivosus W. G. Smith

This plant, very commonly cultivated in gardens, and particularly used for hedges, in southern Florida, where it grows luxuriantly, has begun to spread beyond the limits of cultivated grounds. It makes itself perfectly at home in the pinelands and on the edges of hammocks. Specimens were collected near Miami in November, 1904, *Small 2218.* The plant is also becoming naturalized in the West Indies.

THESPESIA POPULNEA (L.) Soland.

Although introduced on the Florida Keys long ago and growing naturally there for many years, this shrub or tree apparently did not reach the mainland until recently. Specimens were collected along the shore of Biscayne Bay near Cutler in 1905, by Dr. S. H. Richmond, of Cutler. The fruits from which these trees originated were evidently floated across the bay from the Keys.

HIBISCUS SABDARIFFA L.

The roselle or Jamaica sorrel, cultivated in southern Florida for its edible flowers, has become established in pinelands and waste places about Miami. The plant is a vigorous grower and thrives exceedingly well in that region. Specimens were collected there in November, 1904, *Small 2280*.

HIBISCUS CANNABINUS L.

The ambaree or brown Indian hemp is naturalized in both pinelands and about hammocks in southern Florida. Specimens were collected near Miami in the fall of 1903 by the writer and Mr. J. J. Carter.

HIBISCUS ROSA-SINENSIS L.

The Chinese rose or shoe-black plant, cultivated throughout peninsular Florida, chiefly for its showy flowers, is naturalized, especially in the southern portions of the peninsula. We have specimens collected on the west coast at Pinellas, by Mr. Otto Frank and on the east coast about Miami by the writer.

JASMINUM GRANDIFLORUM L.

This widely cultivated tropical plant has escaped from cultivation and is growing spontaneously in the pinelands north and south of Miami. Specimens were collected at two stations in November, 1904:

Between Cocoanut Grove and Cutler, *Small 2223*.
About Arch Creek, *Small 2307*.

ANGELONIA ANGUSTIFOLIA Benth.

This tropical American plant, commonly cultivated in gardens has become established as a member of our wild flora in southern peninsular Florida. Specimens were collected in Dade County, in December, 1903, by Mr. A. A. Eaton, *no. 872*.

RUSSELLIA JUNCEA Zucc.

This Mexican shrub, commonly cultivated in gardens, has now become established in peninsular Florida. Professor P. H. Rolfs reports it as especially plentiful about towns on the west coast.

THUNBERGIA FRAGRANS Roxb.

Several species of *Thunbergia* are generally cultivated in Florida, but only one seems to have become naturalized. The species cited above was collected growing wild in waste places as early as 1894, at Eustis, *Nash 728*. The writer has observed it in similar localities at several towns in the peninsula.

PAEDERIA FOETIDA L.

This vine, remarkable for the very offensive odor of its foliage when bruised, has become established about Sanford. Specimens were collected there by Mr. S. Rapp in 1903.

TRIDAX PROCUMBENS L.

This tropical American species, hitherto known as a member of our flora only from the Florida Keys, is now very plentiful and permanently established in southern peninsular Florida. Specimens have been collected as follows:

Miami, November, 1903, *Small & Carter*.

Dade County, December, 1903, *Eaton 458*.

Between Cocoanut Grove and Cutler, November, 1904, *Small 2230*.

Near Arch Creek, Dade County, November, 1904, *Small 2245*.

EMILIA SONCHIFOLIA (L.) DC.

This plant of the old world tropics is now firmly established in southern Florida, where the following collections have been made:

Dade County, *Eaton 1150*.

Palm Beach, *Small 2129*.

Between Miami and Kendall Station, *Small & Carter 2755*.

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GARDEN—No. 140

STUDIES ON THE ROCKY MOUNTAIN FLORA—XXIV

By PER AXEL RYDBERG

NEW YORK
1910

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL
CLUB **37:** 541–557. 30 N 1910

[From the Bulletin of the Torrey Botanical Club, 37: 541-557. 1910]

Studies on the Rocky Mountain flora — XXIV

Per Axel Rydberg

Saussurea densa (Hook.) Rydb. sp. nov.

Saussurea alpina densa Hook. Fl. Bor.-Am. **1**: 303. 1833.
Saussurea alpina Ledebouri A. Gray, Syn. Fl. **1**^{2}: 397. 1884. Not *S. Ledebouri* Herder, 1810.

Saussurea Ledebouri Herder was based on *S. subsinuata*, *S. nuda*, and *S. Tilesii* of Ledebour, which Herder united into one species under another name. All three are illustrated in Ledebour's Icones Fl. Ross., and it is evident that *S. alpina densa* Hook. is different from each of them. None of the three illustrations shows the elongated, acuminate outer bracts, characteristic of *S. densa*. Only *S. nuda* shows a dense inflorescence with subsessile heads and a low stem, but the heads are fewer and less crowded, the stem is naked above, and the leaves entire.

S. densa is a plant of the higher mountains of the Canadian Rockies.

Saussurea remotiflora (Hook.) Rydb. sp. nov.

Saussurea alpina remotiflora Hook. Fl. Bor.-Am. **1**: 303. 1833.
Saussurea alpina A. Gray, Syn. Fl. **1**^{2}: 396, in part. 1884.
Saussurea nuda Britt. & Rydb. Bull. N. Y. Bot. Gard. **2**: 187. 1901. Not. *S. nuda* Ledeb. 1829.

This species is nearer to *Saussurea subsinuata* Ledeb. than to either *S. alpina* or *S. nuda*, but the inflorescence is laxer and the involucre is different, judging from Ledebour's illustration. *S. remotiflora* grows on low ground from northern Saskatchewan to Yukon and Alaska.

CARDUUS

So many species of thistles have lately been described from the Rocky Mountains that the number has more than doubled since the issue of Gray's Synoptical Flora. Some of these species should be reduced to synonymy and some of them are probably hybrids, but I think that the larger number will remain as good species. It seems as if it should be unnecessary to propose more, but it has been impossible for me to include the following four in any known species.

Carduus polyphyllus sp. nov.

Carduus scopulorum Rydb. Mem. N. Y. Bot. Gard. **1**: 449. 1900.
Not *C. scopulorum* Greene. 1892.

Perennial; stem stout, 3–8 dm. high, very leafy, angled, arachnoid-hairy; leaves 1–2 dm. long, linear in outline, deeply pinnatifid, with lanceolate divisions ending in yellow spreading spines, green on both sides, sparingly arachnoid-hairy; heads hemispheric, about 3 cm. high and broad, usually numerous, sessile in the axils of the leaves, often forming a leafy spike 2–3 dm. long; bracts linear-subulate, densely arachnoid-hairy, the outer with rather long yellow spines often 1 cm. long, the inner attenuate into slender straight tips; corollas straw-colored; pappus plumose with slender, barbellate tips.

In my Flora of Montana, I referred this species to *Carduus scopulorum* Greene. The latter was based on *Cnicus eriocephalus* or *Cirsium eriocephalum* A. Gray, the type of which was collected by Parry in Colorado. The rather common Colorado plant is characterized by its leaves, which are grayish-tomentose beneath, and by its heads conglomerate at the end of the stem, forming a cluster which at first is nodding. *Carduus polyphyllus* is more closely related to *C. Kelseyi* and *C. Tweedyi*. From the latter it differs in the straw-colored instead of red corollas, the narrower bracts, and more numerous leaf-lobes, and from the former in the deeply dissected and decidedly crisp leaves. If the leaves are lobed at all in *C. Kelseyi* the spines are directed forward and the blades are almost perfectly flat.

MONTANA: Mountains near Indian Creek, July 21, 1897, *Rydberg & Bessey 5216* (type, in herb. N. Y. Bot. Gard.); Park Co., Aug., 1887, *Tweedy 349*.

Carduus Butleri sp. nov.

Perennial or biennial; stem angled, striate, purple, sparingly arachnoid-hairy, very leafy, 6–10 dm. high or more; leaves linear-oblanceolate or linear, almost entire or sinuately lobed, spinulose-ciliate and if lobed the short lobes ending in slightly stronger spines, green and sparingly arachnoid above, grayish-tomentose beneath; heads few, ending the stem and short branches, subtended by narrowly linear spinulose-ciliate leaves, hemispheric, about 4 cm. high, 4–5 cm. wide; outer bracts lanceolate, brownish, glabrous or nearly so, ending in short weak spines 2–3 mm. long, the innermost linear-lanceolate, attenuate, ending in slender brownish or purplish somewhat twisted and spreading lance-linear tips, these neither dilated nor erose; corollas pinkish; pappus plumose; tips more or less clavate.

This species resembles *Carduus Kelseyi* and *C. foliosus* in the leaves, but differs from both in the scattered few heads and purplish stem. In both species mentioned, the heads are conglomerate at the end of the stem. In *Carduus Kelseyi* the involucral bracts are much narrower and decidedly arachnoid. In *C. foliosus* the bracts are somewhat broader than in *C. Butleri*, the inner ones have dilated, lanceolate and erose tips, and the leaves are usually more lobed.

MONTANA: Big Fork, July 28, 1908, *B. T. Butler*, *674* (type, in herb. N. Y. Bot. Gard.); also near Rost Lake, *677*.

Carduus lacerus sp. nov.

Probably biennial; stem stout, 6–10 dm. high, sparingly arachnoid, angled and striate; lower leaves oblanceolate, 2–3 dm. long, pinnatifid, with rather broad, ovate or lanceolate divisions ending in weak spines, glabrous or slightly long-hairy and green above, grayish tomentose beneath; upper leaves lanceolate, sessile and clasping, with somewhat narrower lobes and rather stout spines; heads more or less clustered, about 4 cm. high and broad; outer bracts ovate-lanceolate, glabrous, without glutinous ridge, ending in short stout spreading spines 3–5 mm. long; inner bracts with dilated, ovate, abruptly acuminate, erose and crisp, spreading tips; corollas rose-colored; pappus plumose; tips slightly clavate.

This species was probably included in *Cnicus scariosus* by Gray, judging from his description in the Synoptical Flora; but it is not *Cirsium scariosum* Nutt., for Nuttall characterized the latter as having arachnoid-hairy involucres, the bracts with dilated erose tips, and the leaves tomentose beneath. I know of only one species which agrees with this characterization. This is well represented by *Flodman 880*, which was distributed as *Carduus Hookerianus*.

UTAH: Wahsatch County, near Midway, July 6, 1905, *Carlton*

& Garrett 6732 (type, in herb. N. Y. Bot. Gard.); apparently also, Salt Lake City, August, 1880, *M. E. Jones 1905*, and the same locality, Sept., 1905, *A. O. Garrett 1718*.

Carduus olivescens sp. nov.

Perennial; stem slender, somewhat tinged with purple, more or less floccose, 4–8 dm. high, leafy; leaves linear in outline, 1–2 dm. long, densely white-tomentose beneath, loosely floccose above, deeply pinnatifid, with numerous lanceolate, often 2- or 3-cleft lobes, ending in short yellow spines; heads few, peduncled, about 3 cm. high, 3–3.5 cm. wide; bracts slightly floccose on the margins, light olive-colored, darker towards the apex, ending in yellow spines 2–4 mm. long, or the innermost with lance-linear, slightly twisted yellowish tips; corollas straw-colored; pappus plumose; tips slightly clavate.

This species was first determined questionably as *Carduus Tracyi*, to which it is not closely related, not having the conspicuous broad glutinous dorsal ridges or the broad bracts of that species. In leaf-form it resembles somewhat *C. pulcherrimus*, although the upper surface is more floccose, but otherwise it is not close to that species.

UTAH: Aquarius Plateau, August 5, 1905, *Rydberg & Carlton 7450* (type, in herb. N. Y. Bot. Gard.).

Thistle hybrids are very common in Europe and even tertiary hybrids have been reported. No attempt has been made in this country to segregate or recognize hybrids in this genus. As a rule specimens of thistles are not so common in herbaria as would be expected, probably owing to the difficulty in collecting and preparing them.

Thistles are not uncommon in the Rocky Mountains, especially in Colorado. No person has perhaps contributed more to the knowledge of these plants of that state than Mr. George E. Osterhout, of New Windsor, Colorado. He has described a few species himself and others have been described from material collected by him. There are still more forms recognized by him and distributed under manuscript names, but which he has been reluctant to describe. With the aid of the material sent me by him, augmented by other specimens collected by Baker, Shear, Clements, myself, and others, it has been possible to recognize a good many forms which I regard as hybrids. The two species which seem to have produced the most hybrids are *Carduus americanus* (A. Gray) Greene (not Rydb.) and *C. griseus* Rydb. The former of these is comparatively common in Colorado, but the latter is rather rare. Several of the specimens cited under the latter in my Flora of Colorado do not belong to it, but are hybrids of *Carduus americanus* and various species. The original of *C. griseus* and later specimens collected by Osterhout do not have the bracts dilated at all or erose; the spines of the involucral bracts are long and somewhat flattened, and the leaves are darker and less deeply divided than in *C. americanus*. The following probable hybrids have been recognized, but, like Mr. E. P. Bicknell, in the matter of *Rubus* hybrids,* we wish "to divest the subject from all nomenclatorial claims" and "to be understood merely as pointing out the probability of the occurrence of the hybrids mentioned."

CARDUUS AMERICANUS×GRISEUS

This has the leaves of *C. griseus*, *i. e.* dark green above, grayish-tomentose beneath and with short lobes, as well as the strong and broad spines of the involucral bracts of that species, and some of the outer bracts are spinulose-ciliate; but most of the bracts are erose on the margins and the inner ones have dilated tips as in *C. americanus*. The following specimens are to be referred here:

COLORADO: Toland, Gilpin Co., July 20, 1906, *Osterhout 3266;* Ward, Boulder Co., July 17, 1901, *Osterhout 2429.*

The former of these was labeled by Osterhout *Carduus erosus* Rydb. (?). The original *C. erosus* is quite different. To strengthen the probability of hybridity, it may be mentioned that Mr. Osterhout has sent in specimens of one of the supposed parents, viz., *C. griseus*, also from Toland, Gilpin Co., collected on the same date, his *3267*, the next number, and that *C. americanus* is a rather common plant in Colorado.

The latter of the two specimens was determined by me as *C. griseus*, although I now regard it as a hybrid of that species and *C. americanus*. *C. americanus* has been collected at Ward, by Tweedy.

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* Bull. Torrey Club **37**: 399. 1910.

CARDUUS AMERICANUS × SPATHULATUS

This resembles most *C. americanus* in habit and leaf-form; the bracts are somewhat erose on the margins as in that species, but they are scarcely at all dilated, and if so only the innermost, and they are tipped with the short and broad spines characteristic of *C. spathulatus*. To this are referred:

COLORADO: Estes Park, Aug. 16, 1905, *Osterhout 3091;* Sulphur Springs, July 16, 1905, *Osterhout 3057;* Happy Hollow, July 14, 1898 (collector not given), Herb. State Agric. College, *no. 2801.*

The last was distributed as *Carduus griseus* and has perhaps given rise to a wrong impression of that species. *C. spathulatus* was then undescribed and the bracts excluded no. 2801 from *C. americanus*. We have no specimens of either of the supposed parents, from exactly the same locality, but *C. americanus* is found nearly everywhere in the mountains of northern Colorado, and Osterhout in the original description of *C. spathulatus* states that it is common on both sides of the range of mountains east of the North Park.

CARDUUS AMERICANUS × COLORADENSIS

Carduus erosus Rydb. Bull. Torrey Club **28**: 507. 1901.

This was originally described as a distinct species. Professor Nelson reduces it to a synonym of *Carduus americanus*. The broad hemispheric head, the broad bracts with less dilated tips, and the more spiny leaves with more numerous and lanceolate lobes are very different from those of the typical *C. americanus*. The form and structure of the involucre, the form of the leaves, and the habit approach those of *C. coloradensis*. The upper surface of the leaves and the midrib beneath show some of the arachnoid hairs characteristic of *C. coloradensis* and its allies. We have no specimens of the two supposed parents from Durango, the type locality of *C. erosus*, but the locality is not without the range of either.

COLORADO: Durango, 1896, *F. Tweedy 517*.

CARDUUS ACAULESCENS × AMERICANUS

This resembles most *C. americanus*, but the stem is lower, the heads crowded, the involucral bracts elongated and less dilated at the tip, the leaves have more lanceolate lobes and stronger spines, and the stem and midribs of the leaves are more or less arachnoid-hairy. The clustered heads, the arachnoid pubescence on the stem, and almost glabrous bracts, with broad bases gradually tapering upwards, would suggest *C. acaulescens* as the other parent.

COLORADO: Plains and foothills near Boulder, July, 1903, *Tweedy 5852.*

CARDUUS ACAULESCENS × COLORADENSIS

Carduus acaulescens (A. Gray) Rydb. and *C. coloradensis* Rydb. are closely allied and many regard them as forms of the same species. As they often grow together and intermediate forms are found, this disposition seems plausible, but these intermediate forms may as well be explained by hybridity. The typical *C. acaulescens* has practically no stem and the small campanulate heads, seldom more than 3 cm. wide, are sessile and congregated in a flat-topped head-like cluster, while the typical *C. coloradensis* has a stem 3–10 dm. high and the larger heads are more or less peduncled, 4–7 cm. broad, hemispheric, and scattered. The intermediate forms are usually low-stemmed and the heads, intermediate in size and shape, are in a dense flat-topped cluster at the end of the stem. At the south end of Fish Lake, Utah., *C. acaulescens* and *C. coloradensis* were found together by myself and Mr. Carlton and the specimens in the New York Botanical Garden bear the numbers *7547* and *7546*, respectively. The supposed hybrid also was collected, although I can not find any specimens now in the collection of the New York Botanical Garden. They may have met the same fate as some other specimens of the collection in being damaged by rain. There is one specimen, however, in our herbarium, which I regard as belonging to this hybrid, viz.

COLORADO: Sulphur Springs, Grand Co., Aug. 8, 1907, *Osterhout 3615.*

CARDUUS ACAULESCENS × SCOPULORUM

Carduus crassus Osterhout, MS.

This was distributed under the manuscript name cited above and regarded by Osterhout as a distinct species. I am inclined to think it a hybrid of the two species mentioned for the following reasons. The form and the pubescence of the leaves are almost exactly those of *Carduus acaulescens*. The small and clustered heads also suggest that species; but the plant has an evident stem and the involucre is decidedly arachnoid-hairy. As *C. scopulorum* and *C. Parryi* are the only species in Colorado which have arachnoid involucres, one of these may be supposed to be the other parent. As *C. Parryi* has also dilated erose bracts, it must be thrown out of consideration. In *C. crassus* the involucral bracts have also the long slender spines characteristic of *C. scopulorum*.

COLORADO: Sulphur Springs, Grand Co., July 17, 1905, *Osterhout 3042*.

Neither of the two supposed parents is represented by specimens from Sulphur Springs, but there is a specimen, *Osterhout 3615*, just cited above, which I regard as a hybrid of *C. acaulescens* with another species.

CARDUUS GRISEUS×LATERIFOLIUS

Carduus canalensis Osterhout, MS.

This I included in *Carduus griseus* in my Flora of Colorado but it differs in many respects from the type of that species, the leaves being much broader and less lobed, the upper leaves with broad auricles and the inner bracts with dilated erose tips. These two characters suggest *C. laterifolius*, from which it differs in the long and broad spines of the outer bracts, characteristic of *C. erosus*.

COLORADO: Canyon of Thompson River, Larimer County, August 16, 1905, *Osterhout 3089*.

This specimen was collected together with the type number of *C. laterifolius*, viz., *Osterhout 3090* (the next number).

CARDUUS GRISEUS×SCOPULORUM

Carduus Osterhoutii Rydb. Bull. Torrey Club **32**: 131. 1905.

This has the habit, the leaf form, and the long flat spines of the bracts of *Carduus griseus*, but the inflorescence is conspicuously arachnoid-hairy as in *C. scopulorum* and the leaf segments are rather more numerous than in *C. griseus*. The following specimens belong here:

COLORADO: Red Cliff, Eagle Co., July 17, 1902, *Osterhout 2706*; Tennessee Pass, July 28, 1902, *Osterhout 2640.*

The first of these specimens was associated with *Carduus griseus, Osterhout 2707* (the next number), collected at the same date and locality. *C. griseus* was collected at Red Cliff in 1906 also, *Osterhout 3362. C. scopulorum*, the other supposed parent, is rather common throughout the mountains of Colorado.

CARDUUS GRISEUS × PARRYI

Carduus araneosus Osterhout, Bull. Torrey Club **32**: 612. 1905.

Osterhout in the original description of *Carduus araneosus* suggests the relationship with *C. Parryi*. *C. araneosus* differs from that species mainly in the less greenish corollas, the stouter and broader spines of the bracts, and the grayish under surface of the leaves. These characters suggest *C. griseus*, but the involucral bracts are decidedly arachnoid-pubescent and the inner bracts are more or less dilated above and erose. The following specimens belong here:

COLORADO: Red Cliff, Eagle Co., June 26, 1900, *Osterhout 2169*; and also Aug. 16, 1906, *Osterhout 3363;* Boreas, July 24, 1897, *Crandall 2806;* without locality, *J. Wolf 459* (Wheeler Exp.).

The first two specimens were collected at Red Cliff, where also two numbers of *C. griseus* (see under preceding hybrid) and one of *C. Parryi*, viz., *Osterhout 2708*, were collected.

CARDUUS OREOPHILUS × SCOPULORUM

This resembles *C. scopulorum* in the heads crowded at the ends of the stem, the arachnoid involucres and general habit; but the leaves are broader, with fewer lobes; the involucral bracts are broader at the base, and the flower-cluster not nodding. In these characters it approaches *C. oreophilus*, but it has less deeply dissected leaves with broader lobes, and the inflorescence is much more arachnoid.

COLORADO: Silver Plume, Aug. 23, 1895, *Shear 4948* and *4960.*

Carduus oreophilus also was collected at Silver Plume the same day by Shear, *no. 3258*, and also by Rydberg on the following day. *C. scopulorum* is common in the upper part of Clear Creek above Silver Plume. In the herbarium of the Garden there is one specimen from near Gray's Peak, *Shear 4734*, collected on the same date as *4948* and *4960*.

CARDUUS COLORADENSIS × UNDULATUS

With the specimen cited below, Mr. Osterhout sent a slip of paper on which is written: "Do not think this is *Carduus undulatus* — do not know what it is." It resembles *C. undulatus*, the flowers being red, although paler, the bracts having a glandular dorsal ridge, and the general habit and leaf-form being similar, but the dorsal ridge is very inconspicuous. It resembles perhaps more *C. coloradensis* in habit, in the form of the bracts, and the lanceolate twisted tips of the innermost of these. There is also an indication of arachnoid hairs on the stem, but the corollas are pink, not dirty white, and there is an evident though narrow dorsal ridge towards the ends of the bracts.

COLORADO: Wolcott, Eagle Co., July 11, 1902, *Osterhout 2653*.

Mr. Osterhout collected also *C. coloradensis* at the same date and locality, viz., *2651*.

CARDUUS FILIPENDULUS × OCHROCENTRUS

Carduus dispersus Osterhout MS.

This has the large heads and the long spines of *C. ochrocentrus* but the broad non-decurrent leaves and dark green glabrate upper surfaces of *C. filipendulus*.

COLORADO: Home, Larimer Co., July 29, 1904, *Osterhout 2898*.

Both of the supposed parents are common in Larimer County. Mr. Osterhout doubts that this can be a hybrid between the two supposed parents given above, as he has not seen either growing so far up in the mountains.

CARDUUS FLODMANII × MEGACEPHALUS

This specimen cited below was determined as *Carduus Flodmanii*, but its leaves are much broader and with shorter and broader lobes, the heads are larger, and their bracts more glutinous than in the typical *C. Flodmanii*. The plant is almost exactly intermediate between that and *C. megacephalus*.

COLORADO: Fort Collins, July 30, 1904, *Osterhout 2903*.

Both of the supposed parents are common around Fort Collins.

CARDUUS PLATTENSIS × UNDULATUS

The specimen cited below was sent me by Mr. Osterhout, who suggested that it was a hybrid of *Carduus plattensis* Rydb. and *C. undulatus* Nutt. It has the head of the former, but somewhat smaller and with narrower and less viscid bracts. The leaves also are those of that species but approach those of *C. undulatus*.

COLORADO: Thompson's River, Larimer Co., Aug. 16, 1905, *Osterhout 3087*.

There are many features that suggest hybridity in *Carduus perplexans* Rydb. In the original description, attention was directed to its relationship to *C. Centaureae* (= *C. americanus* Greene) and also to the *C. altissimus* group. At that time I was inclined to regard it as a hybrid between *C. americanus* and *C. filipendulus*, but the broad leaves seemed to contradict such a disposition.

Since that time I have been inclined to regard it as a hybrid of *C. laterifolius* Osterhout and *C. filipendulus*, as the former has broad leaves resembling those of *C. perplexans*. The bracts, erose-tipped as they are, are not much like those of *C. laterifolius*. Mr. Osterhout suggests that it might be a hybrid of an undescribed species, specimens of which he has sent me. In these the bracts resemble those of *C. perplexans* very much and the flowers are also red; but the leaves are narrow and deeply pinnatifid. This species and *C. filipendulus* could scarcely produce a hybrid like *C. perplexans*.

All the supposed hybrids given above were collected in Colorado. Besides these the following are in the herbarium of the New York Botanical Garden from neighboring states.

CARDUUS MEGACEPHALUS × OCHROCENTRUS

There seem to be two rather distinct forms included in *Carduus ochrocentrus*. As both are found in Texas and New Mexico and I have not seen the type specimen, I am uncertain which of the two is *C. ochrocentrus* proper. One of them extends northward to Nebraska and northern Colorado and is the only one found within the range of my studies. For the present I regard this as *C. ochrocentrus*, until further information can be had. It is characterized by strongly decurrent and strongly spinose, crisp leaves, with numerous short crowded lobes and densely white-tomentose beneath. The spines of the involucral bracts are also long and strong, in age usually strongly spreading. *C. megacephalus*, which resembles it in many respects, has much broader flatter leaves, with fewer lobes and short spines, scarcely decurrent and at least the upper ones with broad clasping bases. The spines of the involucres are also short and weak. The following two specimens have leaves resembling those of *C. ochrocentrus* but not decurrent and have involucral bracts with the short weak spines of *C. megacephalus*.

NEBRASKA: Banner County, July 6, 1891, *Rydberg 215a.*

KANSAS: Plains, Ellis County, July 16, 1895, *Hitchcock 309.*

The first of these was collected with *Carduus megacephalus*, *Rydberg 215*. *C. ochrocentrus* was common in the region. *Rydberg 214*, belonging here, was collected a few miles further south. There are also forms intermediate between *C. megacephalus* and *C. undulatus*, but as these two species are so closely related that it is almost impossible to draw a line between them, I have not tried to distinguish any hybrids.

CARDUUS FOLIOSUS × SCOPULORUM

This has the habit and bracts of *Carduus foliosus*, but the involucre is densely arachnoid as in *C. scopulorum* and the leaves have more numerous and crowded lobes, in that respect approaching those of the latter species.

WYOMING: Big Horn Mountains, Aug., 1899, *Tweedy 2120.*

Carduus scopulorum was evidently growing near it, for a specimen belonging to it and collected by Tweedy bears the number *2122*. *C. foliosus* is common in the Big Horn Mountains. Among others are *Tweedy 3051*, collected there the following year.

Carduus Tweedyi, judging from the scarcity of the plant and from the fact that it combines the characters of two groups, may also be a hybrid. A plant of its type may be produced by the crossing of *C. polyphyllus* and a red-flowered species such as *C. Macounii* or *C. edulis* but neither of these two has been found east of the continental divide and *C. Tweedyi* not west of it. A somewhat similar plant would be produced by the crossing of *C. scopulorum* and *C. Eatoni*, but I have seen no specimens of the latter outside of Utah.

CARDUUS BUTLERI × KELSEYI

The leaves of the two supposed parents are very similar, so the differences are mostly found in the inflorescence and the involucral bracts. See under the description of *Carduus Butleri*.

The supposed hybrid has the inflorescence of *C. Kelseyi*, the bracts of *C. Butleri*, but slightly arachnoid-hairy.

MONTANA: Rost Lake, July 28, 1908, *Butler 703*.

Carduus Butleri was collected at the same locality and on the same date, *Butler 677;* and *C. Kelseyi* three days later a little higher up in the mountains, *Butler 398*.

CARDUUS EATONI × OLIVESCENS

Cnicus Eatoni A. Gray included several forms. Three of these had been distinguished by D. C. Eaton, who, however, had applied wrong names for two of them. The first of the three Eatonian synonyms cited by Dr. Gray is *Cirsium eriocephalum* var. *leiocephalum*. Dr. Gray's description also applies principally to this. Hence *Carduus leiocephalus* (D. C. Eaton) Heller becomes a synonym. *Cirsium foliosum* D. C. Eaton, I think, is the same as *Carduus nevadensis* Greene and *C. Drummondii* D. C. Eaton is a Nevada plant, almost identical with *C. oreophilus* of Colorado.

The supposed hybrid under consideration resembles *C. Eatoni* in general habit, but the leaves have fewer and deeper lobes and are grayish tomentose beneath, and the involucres have shorter and weaker spines. It differs from *C. olivescens* in the broader segments of the leaves, the narrower bracts, of which the outer are spinulose-ciliate as in *C. Eatoni*.

UTAH: Aquarius Plateau, Aug. 4, 1905, *Rydberg & Carlton 7422*.

Carduus olivescens also grew on the Aquarius Plateau. The type of it was collected the following day and bears the number *7450*. *C. Eatoni* is common in the same region, although Carlton and myself did not preserve any specimens from the Aquarius Plateau.

CARDUUS PULCHELLUS × UNDULATUS

This most resembles *Carduus pulchellus* in habit, but the involucres are more hemispheric instead of truly campanulate, the bracts are broader and with a narrow glutinous ridge, and the inner ones are not so elongated as in that species. From *C. undulatus* it differs in the narrower segments of the leaves, the glabrate upper surface of the same, the somewhat purple-tipped inner bracts, and the inconspicuous dorsal ridge.

UTAH: Fish Lake, near Twin Creeks, Aug. 8, 1905, *Rydberg & Carlton 7499* and *7487;* Beaver City, 1877, *Palmer 273*.

COLORADO: Grand Junction, June 15, 1900, *Mrs. Stokes*.

Neither of the supposed parents was collected at the same date and locality, but both are found in Utah and Colorado. *C. pulchellus* was collected by Carlton and myself in the neighborhood of Marysvale, *nos. 7016* and *7179*.

A good deal can be said about the treatment of this genus in the New Manual of Botany of the Central Rocky Mountains. Many of the species, reduced to synonymy, have little or no relationship to those of which they were made synonyms.

Under *Carduus americanus* we find the following synonyms: *C. Centaureae* Rydb., *C. erosus* Rydb., and *C. griseus* Rydb. The first is a pure synonym. When the name was proposed I was following the Madison amendments of the "Rochester Code," and according to those amendments an older varietal name invalidated the name *C. americanus*. *C. erosus* I now think is a hybrid of *C. americanus* and *C. coloradensis*. *C. griseus*, on the contrary, is a good species, easily distinct from *C. americanus*, and its bracts have no dilated erose tips. In my Flora of Colorado I included in it at least two hybrids of *C. americanus* with this species and related ones. This may have given Professor Nelson a wrong idea of *C. griseus*.

Under *Carduus Hookerianus* we find as a synonym *C. Osterhoutii*. *C. Hookerianus* is, so far as I know, not found within the United States. It is from the Saskatchewan region. I, as well as others, have referred specimens from Colorado to it, but all these belong to a form of *C. scopulorum*. This may have been the reason why Nelson has made the latter a variety of *C. Hookerianus* under the name *C. Hookerianus eriocephalus*. *C. Osterhoutii* is not closely related to *C. Hookerianus*, but more so to *C. scopulorum*. I think it is a hybrid of that species and *C. griseus*.

Under *Carduus Hookerianus eriocephalus* we find the following synonyms: "*Cnicus eriocephalus* Gray, *Carduus scopulorum* Greene l. c., *C. Tweedyi* Rydb. l. c., *C. araneosus* Osterh. * * * *C. Eatonii* Gray, * * * *C. canovirens* Rydb. l. c. (?) *C. pulcherrimus* Rydb." Of these the two first are pure synonyms. *Carduus Tweedyi* is a related red-flowered species (see page 552). *C. Eatoni*, as I understand it and limited to *C. eriocephalus* var. *leiocephalus* D. C. Eaton, is a good species, forming a group by itself. *C. araneosus* is not related to *C. scopulorum* but to *C. Parryi*, as Osterhout suggested, and is probably a hybrid of that species and *C. erosus*. *C. canovirens* and *C. pulcherrimus* do not belong even near *C. scopulorum*, but to the *C. undulatus* group. *C. canovirens* has no very close relative. The nearest is perhaps *C. canescens* (Nutt.). Nelson once thought it a good species, distributed it under a manuscript name, and would have published it, if his attention had not been called to the fact that it was already published. *C. pulcherrimus* is most closely related to *C. ochrocentrus* and stands to that species nearly in the same relationship as *C. undulatus* does to *C. megacephalus*.

Under *Carduus foliosus* are found the following synonyms: *C. scariosus* (Nutt.) Heller and *C. coloradensis* Rydb. Judging from Nuttall's original description of *Cirsium scariosum*, it is not at all related to *Carduus foliosus* Hook. See remarks above under *C. lacerus*. *Carduus coloradensis* is not to be referred to *C. foliosus*. It was based mainly on *Cnicus Drummondii* of the Synoptical Flora, and is apparently the same as *Carduus Drummondii* of the New Manual, the corolla of which is described as white. The original *Cirsium Drummondii* T. & G., of which there is a duplicate in the Torrey herbarium, has rose-purple corollas The only specimens I have seen from the United States, are from the Black Hills of South Dakota. All the others are from British America.

Carduus oreophilus Rydb. is given as a synonym under *C. Drummondii*. From what is just stated it may be seen that it is not the original *C. Drummondii* and a comparison between my description in the Bulletin of the Torrey Botanical Club and that of *C. Drummondii* in the New Manual shows that it is not *C. Drummondii* as understood by Professor Nelson. *C. oreophilus* is very local and many things suggest a hybrid, but I have failed to find two species that would produce a combination of characters found in *C. oreophilus*. A mixture of four species, *C. pulchellus*, *C. spathulatus*, *C. scopulorum* and *C. coloradensis* might do it. I think therefore that it is best to regard it at present as distinct.

Under *Carduus bipinnatus* (Eastw.) Heller, in the New Manual, we find: *C. pulchella*[*us*], *C. truncatus* Greene(?) and *C. spathulatus* Osterh. The only true synonym is *C. truncatus* Greene. *C. pulchellus* is related to it, but the leaves are white-tomentose beneath. *C. spathulatus* Osterhout is related to *C. griseus*, though its involucral bracts are much shorter. The plant resembles closely *C. americanus*, but the bracts are not at all fimbriate.

Carduus Tracyi Rydb. is, in the New Manual, made a synonym of *C. Nelsonii* Pammel (Pammel did not use the generic name *Carduus* and the page is wrongly cited), while the latter is kept distinct from *C. plattensis* Rydb.

A botanist with broad limitations of species might regard *Carduus plattensis*, *C. Nelsonii*, *C. Tracyi*, *C. brevifolius*, and *C. palousensis* as one species. They are all closely related but each has a definite range of its own. *C. plattensis* belongs to the sandy regions of Nebraska, Kansas, and northeastern Colorado; *C. Nelsonii*, as far as I know, is found only in Wyoming; *C. Tracyi* in southern Colorado; *C. brevifolius* in Wyoming and Montana; and *C. palousensis* in western Idaho and eastern Washington and Oregon. *Carduus Nelsonii* and *C. plattensis* are the most closely related of the four; the only difference I can find is that *C. plattensis* has the inner bracts prolonged into linear lanceolate, spreading, more or less crisp tip, a character not found in the rest. The characters given by Nelson in the key to distinguish *C. Nelsonii* and *C. plattensis* are useless, because the characters assigned to the latter are not true.

Under *Carduus filipendulus* (Engelm.) Rydb., in Coulter & Nelson's New Manual, are given as synonyms: *C. Flodmanii* Rydb. and *C. oblanceolatus* Rydb. The description of *C. filipendulus* is a verbatim copy of my description of *C. Flodmannii*. Little could be said against this, if the two were the same, but this is not the case. In the key, Professor Nelson distinguishes *C. filipendulus* from *C. undulatus*, *C. megacephalus*, and *C. ochrocentrus* by the characters: "Leaves becoming green and glabrate on the upper side" against "Leaves permanently tomentose on both sides." The glabrate character is correct as far as *C. filipendulus* in concerned and was the reason why Dr. Gray associated it with *C. altissimus;* but it is not true of *C. Flodmanii*, for in that species the tomentum is as permanent as in *C. undulatus* and *C. ochrocentrus* and far more so than in *C. megacephalus.* In the key *C. filipendulus* is characterized, but the description is of *C. Flodmanii* under a wrong name. Dr. Gray included *C. Flodmanii* in his *Cnicus undulatus canescens.*

Professor Nelson has admitted a variety *Carduus undulatus canescens* (Nutt.) Porter. Evidently this was unknown to him for he simply copies Gray's characterization of *Cnicus undulatus canescens.* Some years ago, while visiting the Gray herbarium, I was curious to see what Gray meant by this variety. I found that it contained a mixture of *Carduus Flodmanii*, *C. oblanceolatus*, another related species of Arizona, and *Cirsium brevifolius* Nutt. The last is a yellow-flowered species related to *Carduus Nelsonii* and *C. plattensis*, and antedates both. Of these *C. Flodmanii* agrees best with the description of *Cirsium canescens* Nutt., and it might be that species. I have seen, however, a specimen of another species with strong erect involucral spines, which bore the name *Cirsium canescens* in Nuttall's own handwriting. Whether that specimen was the type or not I do not know, but I have adopted the name *Carduus canescens* for that species. Pammel in his treatise on the Iowa thistles adopted the name *Cnicus canescens* for *Carduus Flodmanii.* If Nelson had followed him, I would not have made any criticism, as there is some doubt as to which the name *canescens* belongs to, *C. Flodmanii* or the species for which I have adopted it.

Professor Nelson has also omitted all the Utah species described by Marcus E. Jones, although most of them belong to the range of the New Manual.

CENTAUREA and ARCTIUM

Neither of these two genera are included in the New Manual, although *C. Cyanus* has been collected at several places in Montana, *C. solstitialis* L. at Salt Lake City, Utah, and *A. minus* Schk. in Colorado.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

CONTRIBUTIONS FROM THE NEW YORK BOTANICAL
GARDEN—No. 141

STUDIES ON THE ROCKY MOUNTAIN FLORA—XXV

By PER AXEL RYDBERG

NEW YORK
1911

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL
CLUB 38: 11–23. 15 F 1911

From the Bulletin of the Torrey Botanical Club, 38: 11–23. 1911

Studies on the Rocky Mountain flora — XXV

PER AXEL RYDBERG

Ptilocalais macrolepis Rydb. sp. nov.

Perennial with fusiform roots; stem glabrous, 2–5 dm. high, somewhat branched, glabrous or minutely puberulent; lower leaves somewhat petioled, the upper sessile; blades linear-lanceolate, entire or rarely pinnatifid with linear-lanceolate, divergent divisions; heads solitary at the ends of the slender naked branches; involucres turbinate, about 2 cm. high. Calyculate bracts 8–10, lanceolate or linear-lanceolate, 3–6 mm. long; bracts proper 12–15, linear-lanceolate, attenuate; achenes about 7 mm. long, puberulent on the rounded angles or glabrate; pappus-scales lanceolate, 4–5 mm. long, gradually tapering upwards; bristles 6–7 mm. long.

In habit this species is intermediate between *Ptilocalais nutans* and *P. major*, with the head of the latter, but it differs from both in the pappus-scales. In the original description of *Ptilophora major*, Gray gives no description of the pappus, stating that his specimens were too young. In the Columbia University herbarium there is a duplicate of the type, collected by Spalding. This has fairly well developed fruit and shows that *Ptilocalais major* has practically the same pappus as *P. nutans*, i. e., the paleaceous portion is only 2 mm. long, oblong in outline, truncate and somewhat 3-toothed at apex. *P. macrolepis* grows in sandy soil at an altitude of 1200–1500 m.

UTAH: Benches near Salt Lake City, Apr. 30, 1904, *A. O. Garrett 182* (type, in herb. N. Y. Bot. Gard.); Red Rock Cañon, June 11, 1905, *Rydberg 6105*; Salt Lake City, May 12, 1880, *M. E. Jones 1707* (at least in part); benches near Salt Lake, June 1, 1900, *Stokes*.

PTILORIA

Professor Nelson, in the New Manual of Botany of the Central Rocky Mountains, restores the name *Stephanomeria*, following the Vienna Rules.[1] The only criticism I have to make of the treatment of the genus is that he has reduced *Ptiloria ramosa*

Rydb. to a synonym of *S. tenuifolia* (Torr.) Hall. In the herbarium of the New York Botanical Garden there is a good specimen of *P. ramosa* collected by Aven Nelson and Elias Nelson, viz., *no. 5985*. This is labeled *Ptiloria pauciflora* (Torr.) Raf. It agrees well with Nelson's description of *S. pauciflora*, except as to the pappus, but it is very unlike the type of *Prenanthes pauciflora* Torrey, collected by James and preserved in the herbarium of Columbia University. *Ptiloria pauciflora*, so far as I know is not found so far north as Wyoming.

ADOPOGON

Professor Nelson has readopted *Krigia* for this genus and perhaps rightly so, as most of Necker's genera can scarcely be called published. However, he wrongly adopts the name *Krigia virginica* (L.) Nels. for the only species found in the region, notwithstanding the fact that there is an older *Krigia virginica* (L.) Willd.

CREPIS

Under *Crepis runcinata* we find in the New Manual the following synonyms and remarks. "(*C. platyphylla* Greene . . . ; *C. glaucella* Rydb. . . . , *C. tomentulosa*, *C. perplexans*, and *C. petiolata* Rydb. . . . To recognize the foregoing one would first have to assume a hypothetical *C. runcinata*.)" There is hardly need of assuming a hypothetical *C. runcinata*, for there are found in the region where the type of *Hieracium runcinatum* Torr.* was collected at least two plants which agree very well with the original description. One is the plant for which I have adopted the name *Crepis runcinata*, the other is *C. riparia* A. Nels. Most of James' plants are in the old Torrey herbarium, but the type of *Hieracium runcinatum* is not there. Torrey's description is very clear, however, and calls for a strongly hairy plant. All the synonyms cited above, except *C. platyphylla*, represent glabrous plants (except as to the involucres), and more closely related to *C. glauca* than to *C. runcinata*. *Crepis platyphylla* Greene is closely related to *C. riparia* and perhaps not distinct,

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*Ann. Lyc. N. Y. **2**: 209. 1826.

at least it is more closely related to it than is *C. denticulata* Rydb., which Professor Nelson reduces to a variety. A "conservative" botanist would unite *C. platyphylla* Greene (*C. runcinata hispidulosa* Howell) and *C. riparia*. The latter would then be reduced to synonymy, as the former name is three years older In Torrey and Gray's Flora, *Hieracium runcinatum* was transferred to *Crepis* and the authors cite four specimens, of which two, viz., those collected by Drummond (*Crepis biennis β* Hook.*) and by Nicollet are preserved in the Torrey herbarium. These agree with the description of Torrey's *Hieracium runcinatum*. I have adopted the name *Crepis runcinata* for these specimens rather than to transfer the name to *C. riparia*. If Professor Nelson had reduced *C. tomentulosa* to a synonym of *C. glauca*, I would have made no objection, for I myself am somewhat suspicious that it may be only a state or condition of that species. *Crepis petiolata* and *C. glaucella* are closely related to it, and the glandular involucre is the only character which would associate it with *C. runcinata*. *C. perplexans* is closer to *C. runcinata*, but it also is a glabrous plant.

Both *Crepis denticulata* Rydb. and *C. alpicola* A. Nels. are included in *C. riparia parva* A. Nels. *Crepis alpicola* was technically based on *C. runcinata alpicola* Rydb. The type of both the latter and *C. denticulata* are in the herbarium of the New York Botanical Garden and they are not at all alike. Nelson's description of *C. riparia parva* agrees with *C. alpicola* but not with *C. denticulata*. Compare the original descriptions.

Crepis angustata Rydb. is made a synonym of *C. gracilis* (D. C. Eaton) Rydb. The plant described by Professor Nelson is, however, not *C. gracilis* but *C. angustata*. *Crepis gracilis* was established on *C. occidentalis gracilis* D. C. Eaton.† The type of this is *Watson 716*, a duplicate of which is in the Columbia University herbarium. It is a plant exceedingly like *C. scopulorum* in habit, but the involucre is narrower, the bracts fewer, and the achenes distinctly ribbed. Some of the involucral bracts have a few black hairs as they have in *C. scopulorum*. *Crepis angustata*, like *C. intermedia*, never has black hairs. *C. gracilis*

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*Fl. Bor.-Am. 1: 297.

†Bot. King. Exp. 203. 1871.

I think has been redescribed under the name *C. exilis* Osterhout,* omitted by Nelson.

Crepis pumila Rydb. is made a synonym of *C. occidentalis*. *C. pumila* is not only a lower plant, without any trace of black glandular hairs, but it has different, perfectly columnar achenes. Apparently it was included by Dr. Gray in his *C. occidentalis costata*.

Crepis atribarba Heller is made a synonym of *C. barbigera* Leiberg. The two are not even closely related. The latter is not found within the region, and there was no need of even considering it.

Crepis seselifolia sp. nov.

Perennial with an ascending rootstock and short base covered by remains of old leaves; stem 4–6 dm. high, slender, canescent-tomentulose or the upper part glabrous; basal leaves long-petioled; blades 1–2 cm. long, deeply twice pinnatifid, with linear filiform divisions, canescent-tomentulose, caudate-acuminate, with an elongated linear entire end 5–8 cm. long; stem-leaves subsessile, less divided or the uppermost entire and linear-filiform; heads corymbose-paniculate; involucre glabrous, cylindric, about 1 cm. long; calyculate bracts ovate or ovate-lanceolate, only 1–1.5 mm. long; bracts proper 5–7, linear, yellowish green; flowers 5–7; ligules nearly 1 cm. long; achenes somewhat fusiform, striate.

In habit this species resembles most *Crepis gracilis* (D. C. Eaton) Rydb., but the divisions of the leaves are much narrower and often again divided into very narrow divisions, and the involucre is glabrous as in *C. acuminata*. The leaves resemble those of certain species of the genus *Seseli*.

IDAHO: Rocky hillsides, scarce, valley of Big Potlatch River, Nez Perces County, Idaho, June 6, 1892, *Sandberg, MacDougal & Heller 326* (type, in herb. N. Y. Bot. Gard.).

HIERACIUM

Professor Nelson includes both *Hieracium umbellatum* L. and *H. canadense* Michx. in the flora of the Rocky Mountains. Neither is found in the region. *H. umbellatum* is exceedingly rare in America and confined to the extreme northeastern part, evidently an introduced plant. *H. columbianum* on account of its narrow leaves (narrower than in *H. canadense*) has sometimes been confounded with *H. umbellatum*, sometimes with *H. canadense* on account of its hairy stem. The common plant of the West, which has been confounded with both, is *H. scabriusculum* Schwein.* (*H. macranthum* Nutt.†). Narrower-leaved specimens have been named *H. umbellatum* and broader-leaved ones, *H. canadense*. It differs from *H. canadense* in the glabrous stem and finely scabrous-puberulent leaves. *H. columbianum* has long white or yellow hairs on the lower part of the stem.

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* Muhlenbergia 1: 142. 1906.

The true *Hieracium Scouleri* Hook. is not found in the region. A duplicate of the type is in the old Torrey herbarium. It is an almost scapose plant with the broad leaves obtuse at the apex and gathered near the base of the stem. The stem-leaves are few and small and the involucral bracts hirsute with short dark hairs. The plant resembles more *Hieracium albiflorum* in habit than it does *H. griseum* and *H. cynoglossoides*. The plant with long-hairy involucre which, mainly, Dr. Gray described in his Synoptical Flora and Professor Nelson described in the New Manual is not *H. Scouleri*. It should be known as *H. albertianum* Farr.‡

Heteropleura Fendleri (Schultz Bip.) Rydb. comb. nov.

Crepis ambigua A. Gray, Mem. Am. Acad. 4: 114. 1849. Not *C. ambigua* Balb. 1805.
Hieracium Fendleri Schultz Bip. Bonplandia 9: 173. 1861.
Heteropleura ambigua Schultz Bip. Flora 45: 435. 1862.
Hieracium nigrocollinum S. Wats. Proc. Am. Acad. 25: 133. 1890.

This species has been included in *Hieracium* by Dr. Gray and others. It would be better to include it in *Crepis* than in *Hieracium*, for the achenes are tapering upwards and the pappus is tawny, not white. The involucral bracts are not thickened on the back, however, as they are in most species of *Crepis*, and the general habit resembles perhaps more that of *Hieracium* than of *Crepis*. It does not fit well in either genus, at the same time combining characters of both. Either the two genera should be united or else this species and several others of the southwestern United States and Mexico should be separated as a distinct genus. Even Fries in his Symbolae Hieraciorum recognized this fact and suggested the name *Crepidispermum.* He did not exactly publish the genus and no binomial names were given under the genus. Besides, in the same year a genus *Crepidospermum* B. & H. was published. The two names differ only in one letter, the connecting vowel *i* in one case and *o* in the other. The former is the Latin connecting vowel, the latter the Greek, which is sometimes used in Latin for euphony's sake. The two names may therefore be regarded as identical. The two brothers Schultz of Zweibruecken adopted Fries' suggestion and established the genus under the name *Heteropleura*, as alternate ribs of the achenes are stronger. The present species was given the name *Heteropleura ambigua*, based on *Crepis ambigua* A. Gray. As there is an older *C. ambigua* Balb., that specific name is not available, and hence I have adopted *Heteropleura Fendleri*.

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*Long's Second Exp. 2: 394. 1824.

† Trans. Am. Phil. Soc. II. 7: 446. 1841.

‡ Ottawa Nat. 20: 109. 1906.

AGOSERIS

Professor Nelson reëstablishes the name *Troximon* for this genus, evidently following as he thought the Vienna Rules and cites Nuttall as authority for the genus. This is a similar case to that of *Actinella* and *Tetraneuris.* In fact Nuttall never established a genus *Troximon.* He thought that his two species belonged to the genus *Troximon* Gaert. *Troximon* of Gaertner was established in 1791 on *Tragopogon Dandelion*, *T. virginicum*, and *T. lanatum*, of which the first two belong to one genus, *Krigia* or *Adopogon*, and the last is a *Scorzonera.* Even if Nuttall had established a genus *Troximon*, this would not hold, for then it was not published before 1818 in his Genera, while Rafinesque's name dates from 1817. It is true that *Troximon* appeared in Fraser's Catalogue of 1813, but there it is without description. In his Genera, Nuttall credits Gaertner with the name. So does also Pursh in his Flora, 1814. There is therefore no warrant for reviving *Troximon* for the genus known in later years as *Agoseris*.

A good deal may be said regarding Professor Nelson's treatment of this genus, especially in the way synonyms have been cited. *Agoseris attenuata* Rydb. is given as a synonym of *T. pubescens* (Rydb.) A. Nels. *A. attenuata* has perfectly glabrous leaves, only the involucre and the upper part of the scape being villous. It would be included in *Agoseris pumila* (Nutt.) Rydb., were it not for the decidedly acuminate inner bracts. It has very little indeed to do with the decidedly pubescent *A. pubescens*.

Agoseris maculata Rydb. is made a synonym of *Troximon villosum* (Rydb.) A. Nels. It is true that they much resemble each other in general habit and pubescence, but the outer bracts in *A. villosa* are obtuse or even rounded at the apex, while those of *A. maculata* are abruptly and distinctly acuminate. *A. villosa* is a plant of the lowlands of Montana, westward and northward, while *A. acuminata* is an alpine or subalpine plant of the mountains of Colorado.

Troximon roseum Nutt., *Agoseris agrestis* Osterhout, and *A. roseata* Rydberg are made synonyms of *Troximon glaucum*. I have not seen the type of *T. roseum* Nutt., but, as I interpret it, it is a plant closely related to *T. laciniatum* Nutt., not to *T. glaucum*. *Agoseris agrestis* Osterhout is related to *A. glauca*, but if made a synonym of anything it should be of *Troximon pumilum* Nuttall, having the same pubescent involucral bracts, but the leaves are pinnatifid and caudate-acuminate instead of entire and obtuse or rounded at the apex.

Under *Troximon glaucum dasycephalum* Professor Nelson gives a citation from Piper's Flora of Washington: "This plant differs from *T. glaucum* only in having a pubescent involucre. It is scarcely worth nomenclatural recognition." I think that both Piper and Nelson are incorrect in this statement. In *Agoseris glauca* (Nutt.) Greene the involucre is decidedly obconic, and the leaves narrowly oblanceolate or linear and glaucous; in *Agoseris scorzoneraefolia* (Schrad.) Greene (*Troximon glaucum dasycephalum* T. & G.) the involucre is decidedly campanulate, sometimes in age almost hemispheric, the outer bracts and the leaves broader, and the latter scarcely glabrous. Those who have access to the Botanical Magazine may compare *plate 1667* and *plate 3462*, which give good illustrations of *Agoseris glauca* and *A. scorzoneraefolia* respectively.

Under *Troximon glaucum dasycephalum*, *Agoseris altissima* is given as a synonym. The latter plant is a decidedly pubescent plant and should be associated rather with *A. villosa*, but is taller and its flowers turn deep purple in age.

Under the variety *pumilum* we find *Agoseris Leontodon* Rydb. as a synonym. The latter was based on *Macrorhynchus glaucus laciniatus* D. C. Eaton. Dr. Gray included in his *Troximon glaucum laciniatum* a multitude of forms, in fact everything of the *A. glauca* group with laciniate leaves. *Macrorhynchus glaucus laciniatus* D. C. Eaton is not found east of Nevada. It is related to *Stylopappus laciniatus* Nutt.

Under *Troximon arachnoideum* (Rydb.) A. Nels. are found the following: "*T. glaucum laciniatum* in part (not *T. laciniatum* Gray . . . ; *Agoseris laciniata* Greene; *A. arachnoidea* Rydb. . . .)." The plant described by Professor Nelson is the same as *Stylopappus laciniatus* Nutt. A duplicate of Nuttall's type is in the old Torrey herbarium, and it is to be known as *Agoseris laciniata* (Nutt.) Greene. If *Troximon* is used the name should be *T. laciniatum* (Nutt.) A. Gray, although Dr. Gray described under that name an entirely different plant from Nuttall's *Stylopappus laciniatus*. The type of the latter did not have developed fruit and both Nuttall and Gray thought that it was related to *Stylopappus grandiflorus* Nuttall, or *Troximon grandiflorum* A. Gray. Its achenes are of the *A. glauca* type with short striate beak. (See further below.) To use the name *Troximon arachnoideum* for this plant was entirely out of place, for *Agoseris arachnoidea* Rydberg is an entirely different plant of the *A. aurantiaca* group, with long filiform, non-striate achene-beak, in age purple flowers, and with densely pubescent leaves. Evidently Professor Nelson did not know the plant.

Under *Troximon purpureum* we find the following synonyms: "*Macrorhynchus purpureus* A. Gray . . . ; *T. gracilens* A. Gray . . . ; *A. Greenei* Rydb. as to our range." In the herbarium of Columbia University there is a duplicate of the type of *Macrorhynchus purpureus* A. Gray. It is a low plant scarcely more than 1 dm. high, with narrow, pinnatifid, glaucous and glabrous leaves and brightly spotted involucral bracts. Professor Nelson characterizes his *Troximon purpureum* as being tall, 2–5 dm. high, with leaves tapering into long, slender, winged petioles. Evidently Professor Nelson did not have in mind the true *Macrorhynchus purpureus*, on which *Troximon purpureum* (A. Gray) A. Nels. should have been based, but a mixture of *A. gracilens* and *A. Greenei* Rydb. If any reduction should have been made, *T. gracilens* should have been made a synonym of *Troximon aurantiacum* Hook. In the herbarium of Columbia University there is a duplicate of the type of the latter and one specimen cited in the original description of the former. The only difference I can see is that the outer bracts in *T. aurantiacum* are broader and inclined to be obtuse. As to *Agoseris Greenei* Rydb. the name has to be changed. The plant should be known as

AGOSERIS GRAMINIFOLIA Greene, Bull. Torrey Club 25: 124. 1898.

Troximon gracilens Greenei A. Gray, Proc. Am. Acad. **19**: 71. 1883.

Agoseris gracilenta Greenei Greene, Pittonia **2**: 177. 1891.

Agoseris Greenei Rydb. Mem. N. Y. Bot. Gard. **1**: 459. 1900. Not *Agoseris Greeneana* O. Kuntze, Rev. Gen. Pl. 304. 1891.

Troximon purpureum A. Nels., Coult. & Nels. New Man. Cent. Rocky Mts. 599, in part. 1909. Not *Macrorhynchus purpureus* A. Gray. 1859.

For this species I had adopted the name *Agoseris Greenei*, basing it upon *Troximon gracilens Greenei* A. Gray, but I had overlooked the fact that there had been published an *Agoseris Greeneana* based on *Troximon elatum* Greene. The latter should be known, however, as *A. major* Jepson, published in September, 1891, while Kuntze's name was published in October, 1891.

A closer investigation of *Agoseris graminifolia* persuaded me that it could not be kept distinct from *A. Greenei* (A. Gray) Rydb. although the leaves of the specimens from type collection are more entire than usual. On the sheet in the collection of the New York Botanical Garden they are wholly entire, but the figure published and drawn from the type specimen shows four leaves with a few short lobes.

Under *Troximon arizonicum* Professor Nelson gives as synonyms *Agoseris elongata* Greene, *A. rostrata* Rydb., and *A. humilis* Rydb. The first is only a manuscript name, but the specimens so named are rightly referred to *T. arizonicum*. *Agoseris humilis* is related to *A. gracilens* and *A. aurantiaca* and should have been included in the latter as characterized by Professor Nelson. *Agoseris rostrata* is not closely related to either but is the next relative to *A. grandiflora* of the Pacific Slope, having the same short outer bracts and elongated inner ones and the same very long and slender beak of the achenes, nearly three times as long as the body. It is the "*T. grandiflorum* as to our range," an expression which Professor Nelson erroneously uses under *Troximon montanum*.

Agoseris turbinata sp. nov.

Perennial with taproot and short caudex; leaves narrowly linear, 7–15 cm. long, 1–5 mm. broad, glabrous, bluish green, the midvein and base often purplish, entire, attenuate; scape about 3 dm. high, slender, sparingly villous, more densely so under the head; involucres turbinate, 17–20 mm. high; bracts all narrowly lance-linear, villous on the back as well as on the margins, with dark purple middle and yellowish green margins; ligules 15–18 mm. long, yellow with purplish veins, turning pinkish in age; beak of the achenes short and striate.

This resembles in many respects *Agoseris parviflora* in habit, but differs in the villous scape and involucre and in the beautifully variegated bracts.

ALBERTA: Gravel Slope of Tunnel Mountain, *McCalla 2063* (type, in herb. N. Y. Bot. Gard.).

Agoseris obtusifolia (Suksd.) Rydb. nom. nov.

Troximon grandiflorum obtusifolium Suksd. Deuts. Bot. Monats. 18: 98. 1900.

This is characterized by the broad oblong obtuse lobes and the obtuse or even rounded apex of the leaves. I think that it deserves specific rank. It has been collected in western Idaho.

Agoseris tenuifolia (A. Gray) Rydb. nom. nov.

Troximon grandiflorum tenuifolium A. Gray, Bot. Calif. 1: 438, in part. 1876.

Troximon laciniatum A. Gray, Proc. Am. Acad. 19: 72, in part. 1883. Not *Stylopappus laciniatus* Nutt. Trans. Am. Phil. Soc. II. 7: 432. 1841.

In the Botany of California Gray gives a short description of

Troximon grandiflorum tenuifolium, and points out the characters distinguishing it from *T. grandiflorum*. He gives as a synonym *Stylopappus laciniatus longifolius* Nutt., but a duplicate of the type of the latter collected by Douglas is in the Columbia University herbarium and in this specimen the outer bracts are not dilated as they are in *A. grandiflora* and its relatives.

In the Proceedings of the American Academy, vol. 19, Dr. Gray adopts the name *Troximon laciniatum*, giving as synonyms *Stylopappus laciniatus* Nutt. and its variety *longifolius*; also *Troximon grandiflorum* var. *tenuifolium* and var. *laciniatum* of the Botany of California. A duplicate of Nuttall's type of *Stylopappus laciniatus* is also in the Columbia University herbarium. In later years many specimens matching this specimen have been collected in Wyoming, Colorado, Utah, and Idaho. This is a species with achenes of the type of *Agoseris glauca* and was probably included in Gray's *Troximon glaucum laciniatum*, but it is not *Macrorhynchus glaucus laciniatus* D. C. Eaton. In my Flora of Colorado, I adopted the name *Agoseris laciniata* (Nutt.) Greene for this species. Professor Aven Nelson describes it in the New Manual as *Troximon arachnoideum* (Rydb.) A. Nels. It has nothing to do with *Agoseris arachnoidea* Rydb. See above, p. 18.

TARAXACUM

Professor Nelson's treatment of *Taraxacum* is good. He acknowledges six species, instead of only one as Dr. Gray did. The only criticism I have to offer is that *Taraxacum leiospermum* Rydb. is made a synonym of *T. angustifolium* Greene. It is true that in both the lower part of the achenes is smooth, but otherwise there are several discrepancies between the descriptions of the two. *T. angustifolium* is characterized as having narrow, oblong-linear leaves, and the outer bracts few and small, in a single series, and erect, while in *T. leiospermum* the leaves are broadly oblanceolate and the calyculate bracts are in 2 or 3 series and with spreading tips, as in *T. dumetorum*.

LACTUCA L.

Professor Nelson has given a new specific name to the more common prickly lettuce of the Rocky Mountain region. It has usually been known as *Lactuca Scariola* L., which name has included all the prickly lettuces found introduced in North America, viz., *L. Scariola* L., *L. virosa* L., *L. saligna* L., etc. The plants with merely toothed leaves were referred to *L. virosa* L. by Dr. N. L. Britton, but Mr. L. F. Dewey of the United States Department of Agriculture contends that it is not *L. virosa* but *L. Scariola integrata* Gren. & Godr. Mr. Dewey is followed by Robinson & Fernald in Gray's New Manual. So also by Professor Nelson, but he regards it as specifically distinct from *L. Scariola* and proposes the name *L. integrata* (Gren. & Godr.) A. Nels. This was altogether unnecessary for *L. Scariola integrata* Gren. & Godr.* was based on *L. augustana* All.† Allion gives a good figure.

Linnaeus in his first edition had only one species, *Lactuca virosa*, with three varieties. In the second edition *L. Scariola* is adopted for *L. virosa* var. δ of the first edition. Both *L. virosa* and *L. Scariola* are based on figures in Morison's Historia, and the figure cited under *L. virosa* resembles indeed very much the more common plant introduced in the Rocky Mountain region, much more so than Allioni's plate of *L. augustana* does. The difference between *L. virosa* and *L. Scariola* given by Linnaeus is that the former has toothed horizontal leaves while in the latter they are pinnatifid and vertical. The plant answering the description of *L. Scariola* has been collected in Utah and Montana but the plant with merely toothed leaves is more common. Mr. Dewey's contention may be correct as far as the plant around Washington and Boston is concerned, but I think the plant of the Rockies and the Pacific Slope is *L. virosa*. So far as I know, the leaves are not turned on edge as they are in *L. Scariola* and Professor Nelson describes the achenes of his *L. integrata* as being dark-colored instead of pale. Dewey described the achenes of *Lactuca virosa* as being darker and broader than in *L. Scariola*, while he could not find any differences between those of the latter and the var. *integrata*. There is another character which helps to distinguish *L. virosa* and *L. Scariola*. In the latter, the branches of the panicle are inclined to be racemiform, while in *L. virosa* they are more branched with more or less diverging branchlets.

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*Fl. Tran. 320. 1850.

†Fl. Pedem. 1: 224. 1785.

The Rocky Mountain specimens agree in this respect with *L. virosa.* They have also the obtuse lower leaves of that species as figured by Morison, as illustrated in Sweet's English Botany, in Baxter's British Phaenogamous Botany, and in the Flora von Deutschland. Allioni's illustration of *L. augustana* shows only the upper part of the plant, but all the leaves shown are decidedly acute.

Lactuca polyphylla sp. nov.

Biennial; stem stout, about 1 m. high, glabrous; leaves sessile and slightly auriculate-clasping, very numerous, linear-lanceolate, entire, acuminate, 1–2 dm. long, glabrous, not at all spinulose; panicle conical, much branched, about 3 dm. long, 1.5 dm. broad; involucres about 1 cm. high; outer bracts lanceolate, about half as long as the linear-lanceolate inner ones; achenes nearly black, 3–4 mm. long, oval, indistinctly 3-nerved, transversely rugose; beak about 2 mm. long.

The type was determined as *Lactuca integrifolia* Bigel., but it differs from that purely eastern species in the numerous more willowlike leaves, the stout stem, the numerous heads in a more compact panicle and the short beak of the achenes.

IDAHO: Lake Pend d'Oreille, Aug. 5, 1885, *E. L. Greene* (type in herb. Columbia Univeristy).

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NEW YORK BOTANICAL GARDEN
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GARDEN—No. 142

NOTES ON ROSACEAE—V

By PER AXEL RYDBERG

NEW YORK
1911

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL
CLUB 38: 79–89. 7 M 1911

[From the BULLETIN OF THE TORREY BOTANICAL CLUB, 38: 79–89. 1911.]

Notes on Rosaceae—V

POTENTILLA (*Continued*)*

PER AXEL RYDBERG

FRIGIDAE

In the North American Flora I recognized five species of this group. No essential change was made from my treatment of the group in my monograph, except that I united *Potentilla nana* Willd. with *P. emarginata* Pursh. My conception of *P. nana* had been that it was the same as *P. fragiformis parviflora* Traut., i. e., a depauperate *P. emarginata* with blunter leaves, bractlets, and sepals. Dr. Th. Wolf, who has seen the type of *P. nana*, claims that it is a depauperate *P. fragiformis* instead. The main distinction between *P. emarginata* and *P. fragiformis*, according to Dr. Wolf, is that in the former the styles are scarcely longer than the achenes, while in the latter they are fully twice as long. In *P. emarginata* the styles are short, it is true, but as far as *P. fragifomis* is concerned I have not been able to verify Dr. Wolf's statement. In all the specimens at my disposal the flowers are very young, and the achenes undeveloped, but the styles do not seem very long. Dr. Wolf may be correct, however. At all events *P. nana* should be reduced to a synonym.

Dr. Wolf has also criticised my plate of *P. fragiformis* in my monograph, and rightly so. In the specimen used for the illustration of the plant, the petals had fallen, and I instructed the artist to draw the flower from another specimen, which had better flowers but was otherwise scrappy. Apparently he did not follow my instruction, for the flower represents *P. emarginata* or *P. nivea*.

Dr. Wolf divides the species of this group between his RANUNCULOIDES and AUREAE, referring *P. flabelliformis* and *P. fragiformis* to the former and the rest to the latter group. See my remarks under the AUREAE † group concerning this treatment. *P. Friesiana* is regarded by Dr. Wolf as a ternate variety of the quinate *P. alpestris*, i. e., *P. maculata* as understood in America.

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*See Bull. Torrey Club 37: 487–502. 28 O 1910.

† Bull. Torrey Club 37: 495. 28 O 1910.

BIFLORAE

This group consists of but one species. Dr. Wolf places the group in his section POTENTILLAE TRICHOCARPAE subsection NEMATOSTYLAE, i. e., in a section with hairy ovaries and the filiform style attached at or below the middle of the ovary. The only American species that should be counted to this section is *P. tridentata* or my genus *Sibbaldiopsis*. In his characterization of the group, Dr. Wolf states that the achenes of *P. biflora* only have a bunch of hairs at the scar of insertion. So far as I know they are not hairy at all and the bunch of hairs referred to are the hairs of the receptacle found in all the *Potentillae*. These are unusually long in *P. biflora*. The style in this species is also almost terminal, just as in many typical species of the genus. It is evident that Dr. Wolf has placed this as well as *P. palustris* in a wrong division of the genus.

SAXOSAE

This group consists of three species from Southern California and Lower California. They have much the habit of certain species of *Ivesia*, and for some time I regarded the first known species of the group, *Potentilla saxosa*, as a member of *Ivesia*. Dr. Wolf places *P. saxosa* and *P. rosulata* in the MULTIJUGAE group, but I think that they differ enough from that group to constitute a group by themselves. *P. acuminata* Hall is so closely related to these that I was strongly inclined to reduce it to a synonym of *P. rosulata*. The only essential differences are the thinner leaves and narrower bractlets. Dr. Wolf places it in the RANUNCULOIDES group (a group with digitate leaves), perhaps because the plant is glandular, as is *P. brevifolia*, another pinnate-leaved species referred to the same group by him. On account of the glandular pubescence, Hall thought at first the plant related to the GLANDULOSA group, i. e., the genus *Drymocallis*, and also compares it with *P. brevifolia*. The latter could easily be taken for a species of *Drymocallis*, if the style is disregarded; but *P. acuminata* does not resemble a species of that genus so much. Dr. Wolf remarks: "What separates *P. acuminata* not only from all other species of this group [RANUNCULOIDES of Wolf] but also from all other known Potentillas of the Earth—with the exception of

P. palustris [*Comarum* L.]—are its narrowly ovate, long-acuminate petals." This character would at once have suggested its relationship with *P. saxosa*, for the latter was originally described as having acute petals. Dr. Wolf, however, seems not to have seen the original description, for he only translates my short description into Latin. In my monograph I gave only abbreviated descriptions of the species not found within the United States and Canada.

BREVIFOLIAE

No change in this group has been made since my monograph was published. It consists of only two species, which Dr. Wolf includes in his RANUNCULOIDES. Dr. Wolf claims that a piece of the type of Nuttall's *P. brevifolia* is in Lehmann's herbarium and that this has ternate leaves. Occasionally the basal leaves may have but three leaflets, but this is not the usual case. I have seen Nuttall's type, and a duplicate is in the Torrey herbarium; in both the basal leaves are pinnate with five leaflets.

RUBRICAULES

In the North American Flora I recognized nine species. Of these *Potentilla proxima* was described as new. It is related to *P. Macounii*, but distinguished by the toothed, not deeply cleft leaflets. It is also of a much more southern distribution, found only in south central Utah and Arizona, while *P. Macounii* is found only in Alberta and Montana. The following specimens belong to *P. proxima*:

UTAH: Divide between Sevier and Beaver rivers, near Belknap Peak, July 28, 1905, *Rydberg & Carlton 7369;* also Aquarius Plateau, Aug. 6, 1905, *7479;* mountains north of Bullion Creek, near Marysvale, July 23, 1905, *7157* and *7153*.

ARIZONA: Southern slope, San Francisco Mountains, August, 1904, *Cannon & Lloyd*.

My description of *Potentilla rubricaulis* Lehm. in my monograph was based principally on material collected in the Rocky Mountain region. The species was therefore described as having 5–7 leaflets, while the original has only 3–5 leaflets. I saw my mistake and made a correction in the BULLETIN of the Torrey Club,* proposing the name *Potentilla rubripes* for the Rocky

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*Bull. Torrey Club **33**: 143. 1906.

Mountain plant. Dr. Wolf has called attention to an important difference overlooked by me, viz., that the style in *P. rubricaulis* Lehm. is much thickened and glandular at the base. He therefore includes it in the MULTIFIDAE group. Dr. Wolf also reduces *P. minutifolia* and *P. saximontana* to varieties of *P. rubripes.* As far as *P. saximontana* is concerned it can not be kept distinct from *P. rubripes.* I have come to that conclusion by the aid of material sent me by Mrs. M. E. Soth and others from the Pikes Peak region. Concerning *P. minutifolia* I am still in doubt. If, however, the species are united, the name of the species should not be *P. rubripes*, which name Dr. Wolf adopts, because that is the latest of the three, being 10 years more recent than the other two, which were published on the same page, *P. minutifolia* preceding *P. saximontana* in space.

CANDICANTES

This group contains only one Mexican species, which Dr. Wolf includes in the MULTIJUGAE group.

LEUCOPHYLLAE

In the North American Flora this contains 12 species, of which *Potentilla lupina*, *P. argyrea*, *P. viridior*, and *P. Bruceae* are proposed as new. The first two were based on material formerly included in *P. Hippiana*. *P. lupulina* resembles much *P. Hippiana*, but the pubescence is coarser, less shining, and more gray, the bractlets are small and the sepals are acuminate as in *P. effusa.* It is known from only the type locality and vicinity, and all the material seen was collected by Mr. Frank Tweedy. It is represented by his numbers *3214* and *3215*, of which the latter was assigned as the type.

P. argyrea also is related to *P. Hippiana*, but differs in the dense inflorescence, dull tomentum, and smaller flowers. The dense inflorescence suggests somewhat certain species of the MULTIFIDAE group. One of the specimens was originally labeled *P. pennsylvanica.* Besides the type, the following specimens belong here:

NORTH DAKOTA: Willow City, July 18, 1891, *Lee 219.*

MANITOBA: Britte, June 27, 1906, *Macoun & Herriot 69836.* (This specimen is, however, somewhat doubtful.)

Potentilla Bruceae is related to *P. Breweri*, but differs in the fewer, broader, closely approximate pairs of leaflets. It is known from the type locality only.

Dr. Wolf includes the group in the GRACILES group, which he divides into two divisions. The first, GRACILES PINNATAE, comprises my GRACILES, RUBRICAULES (except *P. rubricaulis* Lehm.), and SUBJUGAE. He makes *Potentilla propinqua* Rydb. (*P. diffusa* A. Gray, not Willd.) a variety of *P. Hippiana*, and both *P. coloradensis* and *P. rupicola* varieties of *P. effusa*. If the author can be accused of splitting up the species too finely, Dr. Wolf especially in this case can be accused of lumping together rather clearly distinct species. *P. propinqua*, as known from field study, shows itself very distinct from *P. Hippiana*, but much less so from the typical *P. pulcherrima*. Sereno Watson saw this close relationship and united the two under the name *P. Hippiana* var. *pulcherrima*. The main differences are that *P. propinqua* is usually lower, decumbent at the base, and its leaves have 9 leaflets, directed somewhat forward; while *P. pulcherrima* is usually taller, more erect, and its leaves have generally only 5–7 leaflets, of which the lower are spreading or even reflexed. Concerning the relationship of *P. pulcherrima* to *P. gracilis* and *P. filipes*, see my remarks in the BULLETIN OF THE TORREY BOTANICAL CLUB **37**: 491. 28 O 1910.

Dr. Wolf proposes a new species, *Potentilla Osterhoutiana*.* I have not seen the type nor any duplicate thereof. From the description, it seems to me to be a luxuriant form of *P. rubripes* or else the same as my *P. viridior*. I have written to Mr. Osterhout for material, but he has answered me that he has no specimens of the number cited by Dr. Wolf. He does not know what it is. From the date and locality given he thinks that it may be *P. rubripes*.†

MULTIJUGAE

This group contains, in the North American Flora, sixteen species, of which *Potentilla klamathensis*, *P. versicolor*, and *P. Nel-*

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* Bibl. Bot. **16**: 200. 1908.

† After this article was written, Mr. G. E. Osterhout has sent me a specimen, *Osterhout 1502*, which he thinks might be *P. Osterhoutiana*. It is an unusually large specimen of *P. rubripes*. The only thing that speaks against this being a duplicate of the type of *P. Osterhoutiana* is that it was collected July 12 instead of July 20.

soniana were proposed as new, and *P. crinita* and *P. Lemmoni* were transferred from the LEUCOPHYLLAE group.

Potentilla klamathensis is related to *P. millefolia* and *P. Hickmani*, but differs in the long, ascending, at last spreading pubescence. Dr. Wolf cites a specimen under *P. millefolia*, from Goose Lake. This is perhaps Cusick's specimen cited below, as *P. millefolia* is unknown outside of California. The following specimens belong to *P. klamathensis*:

OREGON: Fort Klamath, Aug. 7, 1894, *Leiberg 660;* Swan Lake, Klamath Co., 1896, *Applegate 167;* Goose Lake Valley, Aug. 19, 1901, *Cusick 2768.*

Potentilla versicolor resembles *P. plattensis* in leaf form, but the younger leaves are tomentose as well as strigose, and the pedicels are erect or ascending, not arcuate-spreading in fruit. The species is therefore more closely related to *P. ovina* and *P. wyomingensis*, but is distinguished by the tomentum. It is known from the type locality only.

Potentilla Nelsoniana is based on *P. pinnatisecta* A. Nels.,* as to the description and specimens distributed by Professor Nelson. He adopted the name from *P. diversifolia* var. *pinnatisecta* S. Wats.† An examination of Watson's type shows that it is the same as *P. ovina* J. M. Macoun.‡ Dr. Wolf makes it a variety of *P. plattensis*, stating: "I have tried for long time but in vain, to find on specimens received from the author of the species (Mr. Aven Nelson) himself characters specifically distinctive from *P. plattensis*. . . . In the organs of the flowers as well as in all other important points, one can find between *P. plattensis* and *P. pinnatisecta* even with the microscope no distinctions which warrant a specific distinction." Both Professor Nelson and myself have studied the plants in the field. The main distinctions are as follows: *P. plattensis* has a deep taproot with a short perennial crown branching just at the surface of the ground and sending out numerous, decumbent, or rarely ascending, leafy stems, with numerous flowers on pedicels which at least in fruit are arcuate-spreading. In both *P. Nelsoniana* and *P. ovina* there is a distinct

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*Wyo. Exp. Sta. Bull. **28**: 104. 1896.

†Bot. King's Exp. 87. 1871.

‡Can. Rec. Sci. **6**: 464. 1896.

cespitose, scaly, thick subterranean rootstock, the branches of which bear at the summit numerous basal leaves and short erect or ascending stems bearing only reduced leaves. The pedicels are in fruit erect or strongly ascending. These are characters that need no microscope to be seen. The distinction between *P. Nelsoniana* (*P. pinnatisecta* A. Nelson) and *P. ovina* (*P. diversifolia pinnatisecta* S. Wats.) are that the leaflets of the former are cuneate in outline, glabrate in age, and cleft only above the middle; while in *P. ovina* they are obovate in outline, permanently hairy, distinctly pectinately pinnatifid. The latter is a much smaller plant than the former.

Dr. Wolf also makes *P. wyomingensis* a mere form of *P. plattensis pinnatisecta*, and this is done evidently without having seen any specimens, for he states: "From the long diagnosis of the author can it absolutely not be seen how this 'species' can be specifically distinguished from his *P. pinnatisecta*." The fact is that the type of *P. wyomingensis* is a better developed specimen of *P. monidensis* A. Nelson, which Dr. Wolf regards as a distinct species. *P. monidensis* was described from specimens just coming into bloom. Aven Nelson, in the New Manual of the Central Rocky Mountains, keeps them distinct. The differences given, especially the form of the petals, do not hold.

Concerning *P. decurrens*, a species belonging to this group and most closely related to *P. ovina*, see my Notes on Rosaceae—IV.* As the type of *P. dissecta decurrens* was rather poor I herewith cite better material:

UTAH: Divide between Sevier and Beaver rivers, near Belknap Peak, July 28, 1905, *Rydberg & Carlton 7355;* mountains north of Bullion Creek, near Marysvale, July 23, 1905, *Rydberg & Carlton 7152;* Bromide Pass, 1894, *Jones 5695k.*

Dr. Wolf has also reduced *P. cascadensis* to a variety of *P. Drummondii*, which is simply a matter of opinion. He also places *P. crinita* and *P. Lemmoni* in the GRACILES PINNATAE next after *P. ambigens*, notwithstanding the fact that neither of them has any tomentum.

Potentilla Richardii is transferred to the RIVALES group on account of its style. Dr. Wolf may be correct. I have not seen the type nor any authentic material. The habit, judging from Lehmann's plate, suggests, however, this group and is most like that of *P. arizonica.*

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* Bull. Torrey Club 37: 495. 28 O 1910.

MULTIFIDAE

This group, as treated in the North American Flora, contains 16 species, of which *P. paucijuga* and *P. lasiodonta* are new. The former is probably most nearly related to *P. pseudosericea,* but the stem and petioles are silky-villous with spreading hairs, as in *P. pulchella,* and the inflorescence is open. I have seen no specimen except the type, which in habit resembles somewhat *P. rubripes,* but the styles are quite different and place the plant in this group. The type specimen is mounted on the same sheet with four specimens of *P. propinqua.*

Potentilla lasiodonta was based on material distributed as *P. pennsylvanica* and *P. strigosa.* It has the broad leaflets of the former and the pubescence of the latter, but differs from both in the dense inflorescence, similar to that of certain species of *Drymocallis,* and in the numerous lanceolate divisions of the leaflets. These number 15–21, while in *P. pennsylvanica* and *P. strigosa* there are 9–13. The following specimens belong here:

ALBERTA: Calgary, July 21, 1897, *Macoun 16716.*

SASKATCHEWAN: Tramping Lake, Aug. 4, 1906, *Macoun & Herriot 69810.*

MANITOBA: Rapid City, 1896, *Macoun 12576.*

The MULTIFIDAE are one of the most difficult groups of the North American species of *Potentilla.* The difficulty is to draw lines between species. A conservative botanist might admit but four or five species, viz., *P. pulchella, P. bipinnatifida, P. multifida,* and *P. pennsylvanica,* and maybe *P. virgulata.* Nelson, in the New Manual of the Central Rocky Mountains, admits *P. bipinnatifida* Dougl. (which he, however, has renamed *P. pinnatifida* Dougl.), *P. pennsylvanica* with two varieties, *P. atrovirens,* and *P. virgulata. P. pseudosericea,* he makes a synonym of "*P. pinnatifida.*" *P. pulchella, P. multifida,* and their allies are not found in the Rocky Mountain region. Dr. Wolf admits *P. pulchella, P. pseudosericea, P. bipinnatifida, P. multifida, P. litoralis, P. pennsylvanica,* and *P. glabrella.* Note the differences of opinion. Nelson regards *P. atrovirens* and *P. virgulata* as good species, while Wolf regards both as varieties of *P. pennsylvanica*. Wolf regards *P. pseudosericea* and *P. glabrella* as good species, while Nelson regards the former as a synonym of *P. bipinnatifida* and ignores *P. glabrella* altogether. When such a diversity of opinion exists regarding the limitation of the species, and I in my mind was just as uncertain which should be regarded as species and which as varieties or forms, I treated all that had some characters tolerably constant as distinct species.

Both Wolf and Simmons * regard *P. Sommerfeltii* as a variety of *P. pulchella*. Dr. Simmons states: "but there are in the London collections, no original specimens from Ross's first voyage and the specimens under the name of *P. pulchella* from Melville Island, that I have seen, are really *P. Vahliana*, to which, however, the description does not apply." In the old Torrey herbarium there are some specimens of the Melville collections, gathered by Parry. Two of these are *P. Wahliana* but one is *P. pulchella* as I understand it, a plant with leaves densely silky on both sides, slightly if at all tomentose beneath, and with narrow, linear, acute segments. *P. Sommerfeltii*, as I understand it, has leaves green and almost glabrous above, somewhat silky and densely white-tomentose beneath, with oblong, rather than linear, and obtuse segments. This is the common plant of Spitzbergen, but also found in arctic America.

The original *Potentilla Sommerfeltii* was collected by Keilhave and found in Sommerfelt's herbarium; it may be the same as *P. Keilhavii* Sommerf.,* which has always been regarded as a synonym of *P. pulchella*. As it has been impossible for me to see the original description of *P. Keilhavii*, I left it as a questionable synonym under that species.

If *P. Sommerfeltii* is regarded as a species, it would not be out of place to regard *P. pulchella elatior* as such. It has been customary to label all tall well-developed plants *P. pulchella* v. *elatior* and all depauperate ones *P. pulchella*. Without regard to size, there are evidently two distinct races (they may be called species, varieties, or forms) known as *P. pulchella*, beside *P. Sommerfeltii* discussed above. One is the typical *P. pulchella* just briefly described. The other is usually, but not always, a larger plant, with the terminal leaflet decidedly petioled, the leaves dark green above, white-tomentose beneath, with oblong or lanceolate divisions and larger petals usually decidedly emarginate. I take it as the same as Lange's *P. pulchella elatior*, but as the name *elatior* is not available as a specific name I proposed the name *Potentilla subarctica*.

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*Vasc. Pl. Fl. Ellesmereland 479. 1906.

†Mag. Naturv. II. 1: 244. 1832.

Dr. Wolf does not admit *P. multifida* to North America, although I included it in my monograph. We have, however, specimens from this continent, which I can not separate from Old World material. Among others may be mentioned the following specimens:

CANADA: Raft River, west coast of Hudson Bay, August 9, 1904, *Spreadborough 62383;* Pipestone Creek, Rocky Mountain Park, July 7, 1904, *Macoun 65150.*

Robinson and Fernald, in Gray's New Manual, reduced *Potentilla litoralis* Rydb. to a synonym of *P. pennsylvanica* L. Their idea of the latter was evidently based on that of Watson, for their description is copied verbatim from that in the sixth edition of Gray's Manual, except that the height of the plant is given in decimeters instead of feet. It is natural to suppose that a plant named *P. pennsylvanica* should have come from the east, and in the fifth edition of Gray's Manual the given range includes even "Pennyslvania?" It is entirely wrong, however, to apply the name *P. pennsylvanica* to our coast plant, which I described under the name *P. litoralis*.

Linnaeus did not describe his *Potentilla pennsylvanica* from a plant collected in Pennsylvania but from plants cultivated in the gardens of Europe under that name. Jacquin, in his Hortus Vindobonensis, illustrated it under that name, and if I am not mistaken Linnaeus had received his specimens from Vienna. Dr. Wolf, who admits *P. litoralis* as a good species states: "This [*P. pennsylvanica* var. *communis* T. & G.; *P. missourica* Schrader] is the true *P. pennsylvanica* of Linnaeus, the one figured by Jacquin, the one cultivated in the botanical gardens since Linnaeus' time and for long time escaped in the vicinity of Paris." Dr. Wolf therefore fully supports my interpretation of *P. pennsylvanica*. What it is, anybody may ascertain for himself by looking up the illustrations of *P. pennsylvanica* in Jacq. Hort. Vind. 2: *pl. 189*, or *P. missourica* in Bot. Reg. 17: *pl. 1412*. 1831. The description in Gray's New Manual is not that of *P. pennsylvanica*, but of *P. litoralis* Rydb. Unfortunately for me the latter name has to give place to *P. pectinata* Raf., which is without doubt the same as our coast plant.

Dr. Wolf regards *Potentilla strigosa*, *P. arachnoidea*, *P. atrovirens*, and *P. virgulata* as varieties of *P. pennsylvanica*, but regards *P. glabrella* as a species. It has no better right to such a place than the rest. I have treated them all as species, although I regard *P. arachnoidea* especially as very close to *P. strigosa*. In proposing the species *P. glabrella*, I cited as a synonym *P. sericea* var. *glabrata* Lehm.,* following Dr. Watson. Dr. Wolf points out that the specimen on which this variety was based belongs to a form of *P. plattensis*. From the characterization I believe that Dr. Wolf is correct, and that the synonym should be eliminated.

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*Hook. Fl. Bor.-Am. 1: 189. 1832.

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RESULTS OF A PRELIMINARY STUDY OF THE SO-CALLED KENAI FLORA OF ALASKA

By ARTHUR HOLLICK

NEW YORK
1911

Reprinted, without change of paging, from the AMERICAN JOURNAL OF SCIENCE, IV. 31: 327-330. Ap 1911.

Art. XXIX.—*Results of a Preliminary Study of the so-called Kenai Flora of Alaska*; by Arthur Hollick.*

Introduction.

During a recent preliminary study of a series of collections of fossil plants from Alaska Peninsula, especially from the vicinity of Herendeen Bay and Chignik Bay, tentatively assumed, for the most part, to represent the flora of deposits to which the name Kenai formation has been applied, a number of facts were brought to light which are of considerable biological interest and which may prove, after critical analysis, to be of value from the standpoint of stratigraphy.

The name Kenai was originally applied to a series of beds exposed in southeastern Alaska, particularly on the shores of Kachemak Bay, Kenai Peninsula,† which at that time were regarded as Miocene or Oligocene in age but are now generally recognized as Eocene. The results attained from the recent studies indicate that, if the use of the name is to be restricted to the beds of the type locality and their equivalents elsewhere, there is also a series of beds, more or less closely associated with them stratigraphically, which may or may not be included in the formation. The ultimate inclusion or exclusion of these latter, either in whole or in part, cannot be determined, however, until all of the paleobotanical evidence has been carefully weighed and compared with whatever stratigraphic observations may be available.

For example, some of the collections contain only Tertiary species. In others, often from the same localities, there is a preponderance of Tertiary species and a minority of Cretaceous. In others the majority are Cretaceous, with certain genera which are identical with those of the Jurassic. The several collections appear to merge into each other without any abrupt break in the paleobotanical sequence, and further careful investigation will be necessary before attempting to draw any stratigraphic line intended to indicate a differentiation of the flora into one undoubtedly of Tertiary and another of Cretaceous age; but the facts may, at least, be described and their biological significance discussed.

Description of the Flora.

The flora represented in the collections thus far studied, if regarded as a unit, is unique so far as North America is concerned. There is none other described from either the United

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† Dall and Harris, Bull. U. S. Geol. Surv., No. 84 (Correlation Papers, Neocene), p. 233, 1892.

States or Canada with which it may be satisfactorily correlated. It contains many species which are identical with those of certain well-defined Tertiary horizons in the United States and, if these species were the only ones represented, the Tertiary age of the beds in which they occur would not be questioned: such species, for example, as *Taxodium distichum miocenum* Heer, *Populus arctica* Heer, *P. Richardsoni* Heer, *Corylus McQuarrii* (Forbes) Heer, *Carpinus grandis* Ung., *Betula Brongniartii* Heer, *Paliurus Colombi* Heer, etc.

Associated with these, however, not only in collections from a single locality but frequently in the same pieces of matrix, are species which elsewhere occur in strata of recognized Cretaceous age, such as *Adiantum formosum* Heer, *Sequoia rigida* Heer, *Sagenopteris elliptica* Font., etc., and others which, if found by themselves, would almost certainly be considered as closely allied to certain Jurassic species, such as *Pterophyllum concinnum* Heer, *Anomozamites Schmidtii* Heer, *Nilssonia comtula* Heer, etc.!

When first examined, it was thought that this association of undoubted Tertiary angiosperm species with apparently Mesozoic types of gymnosperms was impossible, and that collections from different geologic horizons must have somehow become mixed; but the fact that some of these diverse floral elements were often included in the same piece of matrix proved that they must have been synchronous.

Discussion of the Flora.

Unless all of our previous knowledge and experience in relation to the beginning and subsequent evolution of the angiosperms is at fault, it is evident that the presence of highly developed angiosperm species in any flora at once precludes the possibility of regarding it as Jurassic in age. Furthermore, the fact that certain of the angiosperms in the flora under consideration are undoubted Tertiary species makes it imperative to regard the apparent identity of certain of the associated cycads with Jurassic species as untenable and to regard such apparent identity as due to superficial resemblances only. The theory that a specific type could persist throughout such a great length of time as that implied could hardly be accepted on evidence based entirely upon such inconclusive factors. The genera in which the species belong, however, are unquestionably identical with Jurassic generic types; but it is more logical to assume that such types could have continued into Tertiary times than to imagine that highly developed angiosperms could have been in existence in the Jurassic period.

While searching through paleobotanical literature for any possible description of, or reference to, a flora similar to ours, three papers were noted which have a bearing on the subject. Saporta* describes the discovery of a single species of a cycad, *Zamites epibius* Sap. (*l. c.* p. 322), in the middle Tertiary of Provence, France, associated with many of the same angiosperm genera as those represented in the Alaskan flora. He describes and figures it again in his "Études sur la Végétation du Sud-Est de la France a l'Époque Tertiare, Part III,"† compares it with *Z. formosus* Heer from the Jurassic of Switzerland, and says (*l. c.* p. 11): "....*Zamites epibius*, despite its analogy with the Jurassic genus, must necessarily be specifically distinct, especially when one realizes the vast time interval which separates them." The interest and importance which Saporta attached to this single specimen may be inferred from the lengthy discussion which he gives to it in each paper. It is possible that a small fragment in one of our collections, evidently a *Zamites*, may belong to Saporta's species.

The third paper is by Heer,‡ in which he describes and illustrates a Tertiary flora almost identical with ours, from the island of Saghalien, in northeastern Asia, where the same association of angiosperms and cycads occur and in regard to which he remarks (*l. c.* p. 9): "The most striking....is the family of the Cycads..... There are two species, which differ widely from all living ones, but which show a striking and unmistakable identity with Jurassic and Rhaetic forms." Two species of *Nilssonia* are described and figured (*N. serotina* and *N. pygmæa*). The former species is undoubtedly represented in our collections by a number of specimens, and it is interesting to note that one of his figures (*l. c.* fig. 1, pl. II) depicts this species associated with a leaf of *Populus arctica* Heer on one and the same piece of matrix: an association of species which is duplicated in several of the fragments of matrix in the Alaskan collections.

Significance of the Facts.

To those who are familiar with the factors which influence the distribution of our living flora, the presence of cycads, representing a tropical type of vegetation, associated with species of *Populus*, *Corylus*, *Carpinus*, *Betula*, *Juglans*, etc., in far northern latitudes, will appear incongruous; but the fact that such an association existed in those regions in the Tertiary period cannot be questioned. It is evident, of course, that cycads must have continued their existence somewhere throughout both Tertiary and Quaternary times, otherwise they would not be represented in our living flora. Nevertheless, so far as the paleontologic record indicates, they apparently disappeared from the southern and central parts of the North American continent in the Tertiary period and were almost exterminated in similar European latitudes at the same time, but continued to exist in northwestern America and northeastern Asia, until their descendants were in part exterminated and the remainder driven southward by the advancing cold of the Quaternary period to where they are now growing.

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* Bull. Soc. Géol. France, Ser. II, xxi, 314–328, pl. 5, f. 1–3, 1864.

† Annales Sci. Nat., Ser. V (Bot.), viii, pl. 1, f. 1, 1867.

‡ Fl. Foss. Arct., v (Mioc. Fl. Sachalin), 1878.

Their present range of distribution in the New World is between northern Mexico and Bolivia, which affords an approximate indication of the possible extremes of climatic conditions which might have prevailed in Alaska at the time when this flora was growing there. The climate could not have been colder than that of northern Mexico or southern California at the present time, if the cycads are to be regarded as adequate climatic indicators; nor could it have been much warmer, if the associated angiosperm genera are to be regarded in the same light. The logical inference is, therefore, that the climate which was synchronous with this Alaskan flora was about the same as that of southern California and Florida at the present day. We may also be warranted, apparently, in assuming that, at the time when this flora flourished, either the climate of the northern Pacific region was warmer than that which prevailed in the mid-continental areas farther to the south, or else that their meteorological conditions were not identical, thus giving rise to floral differences similar to those which prevail at the present day in the coastal and interior regions of the West.

Finally, the identity of the Tertiary floras of northwestern America and northeastern Asia is confirmatory evidence of a former land connection between the two continents in recent geologic times, which is so strongly indicated by the well recognized physiographic and topographic features.*

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* See "The Probable Tertiary Land Connection between Asia and North America," Adolph Knopf. Univ. Calif. Pub., Bull. Dept. Geol., v, 413–420, 1910.

CONTRIBUTIONS FROM THE NEW YORK BOTANICAL
GARDEN—No. 144

THE PALEOBOTANICAL COLLECTIONS OF THE NEW YORK BOTANICAL GARDEN

By ARTHUR HOLLICK

NEW YORK
1911

Reprinted, without change of paging, from the PROCEEDINGS OF THE AMERICAN ASSOCIATION OF MUSEUMS, 4: 43-52. 1910 [1911]

Reprinted in part from the Proceedings of the American Association of Museums
Vol. IV, 1910

THE PALEOBOTANICAL COLLECTIONS OF THE NEW YORK BOTANICAL GARDEN

INTRODUCTION

The New York Botanical Garden, as far as I am informed, is the only institution in America in which paleobotany has been developed as a distinct and separate museum feature, accompanied by courses of instruction in the subject.

Johns Hopkins University offers a full course in paleobotany, recognizing it as coördinate with other branches of paleontology; but the material available for study purposes is not very extensive or comprehensive and is, for the most part, arranged to illustrate stratigraphic sequence rather than biologic significance.

The United States National Museum maintains a section devoted exclusively to fossil plants, in connection with its general paleontological collections, with two custodians who have charge, respectively, of paleozoic and post-paleozoic plants; but the development of the subject is essentially along geologic lines, in connection with the work of the United States Geological Survey.

In all other institutions of which I have any knowledge fossil plants appear to be regarded only as incidental features of stratigraphic or paleontologic collections.

The New York Botanical Garden, alone among its sister institutions, recognizes paleobotany as coördinate with and as the phylogenetic and logical basis of systematic botany, and it has occurred to me that an account of the history, arrangement, and development of the collections in accordance with this point of view might be of interest.

DESCRIPTION OF THE COLLECTIONS

ORIGIN AND SUBSEQUENT DEVELOPMENT

The nucleus of the collections is the paleobotanical portion of the general geological material gathered together by the late Dr. John Strong Newberry, formerly professor of geology and paleontology at Columbia University. It was separated from the general geological collections of the University, after the death of Dr. Newberry, and was deposited in the museum of the New York Botanical Garden, under an agreement between the two institutions, dated May 3, 1901, at which time I had the honor to be appointed to take charge of its installation and future development.

During the first six years in the museum of the Garden about one-third of the specimens had to remain in storage by reason of lack of cases; but in 1908 the case equipment was doubled and then, for the first time, it became possible to make an approximate enumeration of the specimens and to arrange all of the collections systematically.

The number of specimens included in the original collections is estimated at about 12,000, and the Garden has added, by purchase, by field work, and through donations and exchanges, about 3000, so that the number of specimens now in the museum may be conservatively estimated at not less than 15,000.

ARRANGEMENT AND LABELING

The collections are installed in and occupy exclusively the two wings of the main basement hall, the floor of which is at ground level and laid directly on the ground surface. This is the logical location for such collections in the museum, from the standpoint of both systematic scientific sequence and practical museum economy. Fossil plants represent the ancestral rootstock from which our living vegetation has arisen and their proper systematic location is, therefore, in the basal portion of the building, with the collections representing our modern flora on the floors above; while the actual specimens, by reason of their weight should, naturally, be located on a floor laid upon the solid ground.

A large framed placard, attached to the wall, indicates the character of the collections as a whole, viz.:

MUSEUM OF FOSSIL BOTANY

Remains of Extinct Plants,
the
Ancestors of Plants now existing

The floor space included in the two wings is 6072 square feet, all of which is devoted to display cases, with the exception of two portions, each 16 x 15 feet, at the eastern end of the east wing, partitioned off as rooms for the sorting and preparing of specimens.

The floor arrangement of the cases is based upon stratigraphic sequence. Table and wall cases Nos. 1–4 contain plants of Eozoic and Paleozoic time. Table cases 5–9, Mesozoic. Table cases 10–12 and wall case 5, Neozoic. This sequence of the cases, while it is primarily a geologic and phylogenetic one, illustrating the general evolution of the vegetable kingdom from its beginning, as represented by the remains found in the Eozoic crystalline rocks, to recent times as represented by the contents of peat bog and other surficial deposits, is incidentally also a taxonomic one when broadly viewed, inasmuch as the plants lowest in the scale of life predominate in the older geologic periods and the higher types in the more recent ones. In other words, the relative abundance, from the older formations upward, of algae, pteridophytes, gymnosperms and angiosperms, represented in the arrangement of the cases according to stratigraphic sequence, represents also the taxonomic arrangement of the systematic botanical collections on the museum floors above. This scheme of installation and sequence therefore brings the museum collections, as a whole, into one harmonious expression of the principle of evolution in connection with the vegetable kingdom.

Each collection from any limited locality, or made by any expedition from a more extended area, is kept intact in the drawers of the case where it belongs stratigraphically, as nearly as possible; although occasionally the specimens may represent more than one geological horizon. Whenever possible, also, a copy of the report or other publication in which a collection is described or discussed is deposited with it, in order to facilitate reference to descriptions and illustrations. The only exceptions to maintaining the integrity of the collections are that individual specimens may be withdrawn and utilized for display purposes.

Type and figured specimens are designated, respectively, by means of red stars and blue triangles, and display specimens are selected either because of their relative perfection of preservation as a whole, or in order to illustrate some detail of outline, nervation of structure, or for the reason that they express some idea relating to evolution, geographic distribution, stratigraphic type, method of preservation, or some other special feature.

The number of specimens on display is approximately 3700. Two large labels in each case indicate the general geologic age of the contents, viz., Eozoic, Paleozoic, Mesozoic and Neozoic, and the geologic period or periods represented, viz., Laurentian, Silurian, Cretaceous, Tertiary, Modern, etc. Following are some examples of these labels:

PLANTS OF EOZOIC AND EARLY PALEOZOIC TIME:

Laurentian,

Cambrian, Silurian and Devonian Periods

PLANTS OF MESOZOIC TIME:

Triassic and Jurassic Periods

PLANTS OF NEOZOIC TIME:

Quaternary and Modern Periods

Each specimen, with the exception of the very large ones, is placed upon a separate wooden block with white surface and black sides and front. The front is beveled and provided with a beading along the bottom to hold the specimen label. This label includes the generic and specific name of the specimen; the family, order, or class of plants to which it is referred; the geologic period and subdivision in which it belongs, and the locality or region where it was collected, viz:

Family Betulaceae Birch Family
CARPINUS FRATERNA Lesq.
Tertiary Miocene
Florissant, Colorado

Family Pinaceae Pine Family
PICEA CANADENSIS (Mill.) B.S.P.
Quaternary Glacial
New Dorp, Staten Island, New York

Whenever a figure of any specimen can be secured it is placed alongside the specimen, on the same block. This is often of considerable importance in connection with an adequate display of fossil plants, as many interesting specimens are too obscure to be readily discerned without close scrutiny and frequently require the use of a hand lens in order to detect details. Many such specimens, some of them types, would be useless for display purposes without the accompanying figures.

These several features of the labeling are thought to include about all the explanatory matter that is required for the information of the average visitor; but experience has demonstrated that there are many who lack even the elementary knowledge necessary to understand what the wording of the labels is designed to express. This matter will be discussed later on.

SPECIAL FEATURES

Aside from the educational value of the collections as a whole, in illustrating the ancestry and evolution of our living flora, many of them are, individually, of historical as well as scientific interest, especially those which represent material collected during the prosecution of well-known government explorations and surveys.

Among the latter may be mentioned the collection made in Australia in 1838–1842, by the Wilkes Exploring Expedition, described in the report by Professor Dana, and those secured during the period between 1855 and 1860 by the Northwest Boundary Commission, between Canada and the United States, and the Pacific Railroad, Macomb, Ives, and Raynolds expeditions, in the western and southwestern parts of the United States, which were made the subjects of reports by Professor Newberry.

Also of interest historically are the specimens collected by Professor Newberry about 1850, upon which he based his earliest paleobotanical contribution, "Fossil Plants from the Ohio Coal Basin," published in a series of papers in volumes I and II of the *Annals of Science*, in 1853–1854. These papers are among the earliest contributions to American paleobotany and the specimens represent some of the earliest described American fossil plants.

The entire collection from the Cretaceous of New Jersey, upon which Professor Newberry based his "Flora of the Amboy Clays," issued as Monographs of the United States Geological Survey, volume 26, together with the larger part of the specimens described by the writer in "The Cretaceous Flora of Southern New York and New England," issued as volume 50 of the Monographs of the Survey, form one of the museum features which appears to attract considerable attention and evidently possesses an element of interest by reason of its local character. These specimens include practically all that have ever been collected representing the fossil flora of New York City and vicinity, and those from Staten Island, Long Island, Block Island, and Martha's Vineyard could probably never be duplicated, as they were collected at intervals during the past twenty-five years, at such fortuitous times as the limited plant-bearing beds happened to be exposed, and most of these are now covered up or obliterated.

The value of local collections, in inciting interest and a desire to know more about the objects which may be collected within a relatively short distance from home, can hardly be over-estimated and, in recognition of this fact, two cases devoted to these specimens have been arranged as a special museum feature.

The collections in general, as would naturally be inferred from what has been outlined in regard to the origin of those specially mentioned, are very rich in type and figured specimens. These are being card cataloged as rapidly as circumstances permit and, when the work is completed, these will be arranged alphabetically and printed in pamphlet form for distribution to other institutions and to such persons as may be interested in paleobotanical investigation or research.

The conversion of our modern vegetation into fossil forms, by the various processes of nature, is illustrated by a series of specimens, which include leaves and leaf impressions preserved in pond silt; fragments of vegetation in recently formed sand or clay concretions; contents of peat-bog deposits; wood from swamp and estuary accumulations, partly or completely lignitized or converted into carbon by the process of natural distillation; silicified wood, showing replacement of the tissues through the agency of water carrying silica in solution, and similar specimens showing replacement by iron, lime, or other mineral matter; a variety of plant remains from the vicinity of mineral springs, preserved by incrustation of silicious sinter and calcareous tufa; etc.

This feature is one in regard to which the average person does not appear to be well informed. The popular conception of a fossil is that it is necessarily something very old and that the methods by which it became converted from the living into the fossil form no longer prevail in nature. The fact that fossils are in constant process of formation today, just as they were during every day in the past, is distinctly surprising to most persons, and specimens which demonstrate or illustrate the processes of fossilization are important educational exhibits.

GENERAL COMMENTS

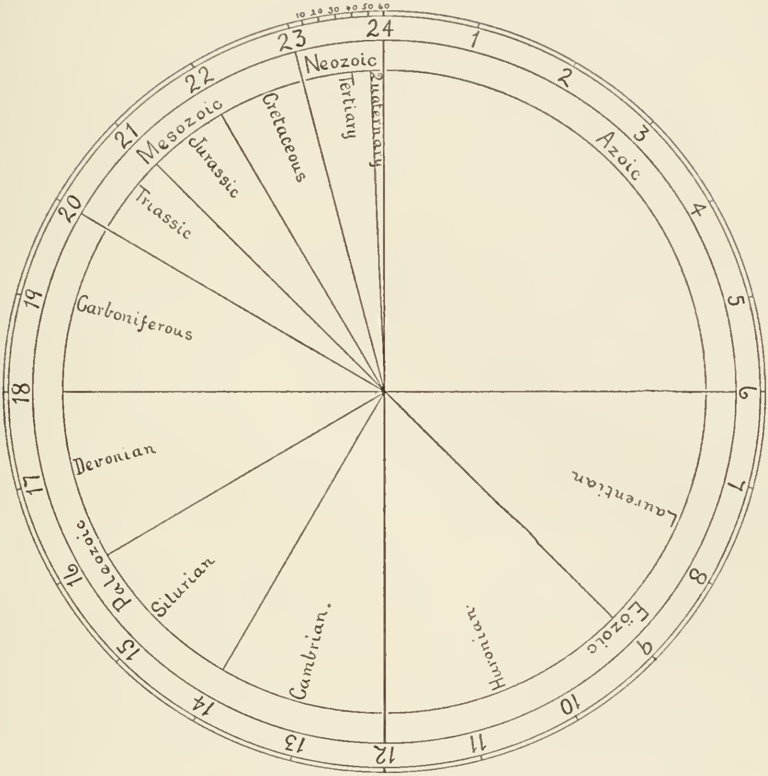
The matter of labeling—that is to say the amount of explanation or information which a label may properly contain—is something which I assume has worried everyone who has had anything to do with the installation and display of museum material. Frequently, after time and careful consideration have been given to the selection, arrangement, and labeling of a collection, some remark by a casual visitor will indicate either that the exhibit fails to express the idea for which it was designed, or else that the visitor was lacking in the elementary knowledge necessary for an adequate conception of what the specimens themselves are, or what they actually represent; and the question that constantly presents itself to the curator and demands an answer is: To what extent is it advisable or permissible to go in connection with explanatory matter on labels?

One visitor who chanced to observe me carefully chipping the matrix, with hammer and chisel, from around a finely preserved fossil leaf, remarked enthusiastically to a companion: "How beautifully he engraves that leaf, doesn't he?" However, the visitors who are not sufficiently well informed to differentiate between a museum of fossil plants and an art gallery are probably very few in number and need not be considered in any scheme of museum economy. Nevertheless, experience has demonstrated that certain factors in connection with fossils in general require careful consideration in regard to explanatory labeling if any display of such objects is to have its proper educational value, even to the person of average information and intelligence. It is not safe to assume the possession, by the general public, of even the most elementary knowledge relating to natural objects.

For example, an astonishingly large number of persons are evidently puzzled over the problem of how a fossil, especially such a fragile object as a leaf or flower, could have become imbedded in solid rock or left its imprint in such hard material. To such persons, of course, some information in regard to the origin of sedimentary rocks is necessary, and some explanation of the difference in origin between sedimentary and igneous rocks, in order that they may not expect to find fossil remains in a trap dyke as well as in the sandstone associated with it, as some occasionally do in connection with the rock of the Hudson River Palisades. How best to impart this information by means of an explanatory chart is something that I have been seriously considering.

Probably the one question which is most frequently asked in regard to a fossil is how old it is, or how long ago in the world's history was the geologic period in which it lived. Disappointment is usually expressed because definite figures in years can not be given. The age of the world, the extent of geologic time, and the slowness of geologic processes, are matters in regard to which most persons apparently have no conception, and a majority are frankly incredulous when tens or hundreds of thousands of years are mentioned in connection with the relatively recent remains of the Quaternary Period, and indefinite millions of years in connection with those which preceded it.

It has occurred to me that possibly a chart, giving the calculations which have been made of time ratios in connection with the primary geologic time divisions, might be utilized in order to convey some idea of this factor, in preference to any attempt to indicate definite figures for the probable antiquity of the several geologic periods. With this idea in view, I have prepared the following chart, adapted from a similar one by Dr. Lester F. Ward:


10 20 30 40 50 60
24
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Neozoic
Tertiary
Quaternary
Cretaceous
Mesozoic
Jurassic
Triassic
Carboniferous
Devonian
Paleozoic
Silurian
Cambrian.
Huronian.
Eozoic
Laurentian
Azoic

This chart is based upon (1), an assumed age for the earth of 72,000,000 years, which is a fair average of the numerous estimates which have been made by geologists and physicists in this connection, and (2), the ratios between the several geologic time divisions as estimated by eminent geological authorities.

The clock dial, representing the cosmic day, is divided into twenty-four hours, hence each hour is equivalent to 3,000,000 years of geologic time.

The estimates of the geologic time division ratios are:

Pre-Paleozoic (Azoic and Eozoic) Time	12
Paleozoic Time	8
Mesozoic Time	3
Neozoic Time	1

Applying these ratios to the hour divisions on the clock dial we have:

	YEARS
Pre-Paleozoic Time	36,000,000
Paleozoic Time	24,000,000
Mesozoic Time	9,000,000
Neozoic Time	3,000,000
	72,000,000

By subdividing each of the time divisions into its appropriate geologic periods the approximate antiquity of each period is indicated.

The even subdivision of Pre-Paleozoic Time into Azoic and Eozoic is purely arbitrary, as is also the indicated time duration of the several geologic periods, except in connection with the Quaternary, which is assumed to include the last 500,000 years of cosmic time, equivalent to the last ten minutes of the twenty-fourth hour, and to represent the period during which man has been in existence.

CONTRIBUTIONS FROM THE NEW YORK BOTANICAL GARDEN—No. 145

NOTES ON ROSACEAE—VI

By PER AXEL RYDBERG

NEW YORK
1911

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL CLUB 38: 351-368. 21 Au 1911

[From the BULLETIN OF THE TORREY BOTANICAL CLUB 38: 351-367. 1911]

Notes on Rosaceae—VI

PER AXEL RYDBERG

ARGENTINA

In an article in Rhodora for January 1909, Prof. M. L. Fernald discussed "The Representatives of *Potentilla Anserina* in Eastern America." The second paragraph of his article reads as follows: "In November, 1908, two extensive monographs of *Potentilla* appeared, but when one turns to these two treatments with the hope of settling his long-standing problems the results are certainly disheartening." And then, "after spending *some days** in the study of the material in the *Gray Herbarium* and the Herbarium of the *New England Botanical Club*," he solves the problems. Fifteen years have now passed since I began my work on *Potentilla* and Dr. Th. Wolf has devoted longer time than that to the study, and neither of us has definitely settled the status of the different forms of this group. When the manuscript of my monograph in the North American Flora went to press I had seen not only the collection in the Gray Herbarium but also those of the New York Botanical Garden, Columbia University, United States National Herbarium, Philadelphia Academy, and the College of Pharmacy, New York. When preparing my original monograph, printed in 1898, I had also seen the collection of the Missouri Botanical Garden. Besides, many of the critical species had been sent to me for determination by the University of California, Mr. T. S. Brandegee, Mr. Parish, and many others.

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* Italics are mine.

In the Gray's New Manual, published September 18, 1908, the authors, Robinson and Fernald, stated under *Potentilla Anserina* as follows: "Var. *grandis* T. & G. is merely a luxuriant state in rich meadows." It is strange that so shortly after, in January, 1909, Professor Fernald should admit this variety as a good species. The difference in the achenes, pointed out by me, evidently persuaded him that it could not be kept in *Potentilla Anserina* L. (*Argentina Anserina* Rydb.). It would have been asking too much if one expected him to admit all at once the eight species recognized in my monograph. My intention is not to defend them as species. The limitation between species and variety will always be arbitrary, so also between variety and form. If Professor Fernald admitted *Argentina argentea* as a variety under the name *Potentilla Anserina* var. *sericea*, he should have admitted *A. occidentalis*, *A. litoralis*, and *A. subarctica* also as varieties. There are certain statements, also, in Fernald's article, to which I must take exception. As Professor Fernald has admitted *Argentina argentea* Rydb. as a variety I should feel content so far as this species is concerned, but I can not pass it altogether. The specimen in the Gray Herbarium from St. John Valley, referred to in Professor Fernald's paper is "in spite of its leaves being silvery on both sides," not *A. argentea*. I remember the specimen very well. Neither is *A. argentea* exactly the same as *Potentilla Anserina sericea* Hayne. Both have leaves silvery on both sides, but in the Rocky Mountain plant the leaflets as a rule are decidedly obovate, with comparatively few ovate teeth, while in the Eurpoean plant the leaflets are usually much longer, elliptic, and with numerous lanceolate teeth directed forward. I have not seen any specimens of *Argentina argentea* east of South Dakota. It needs therefore not to be considered in connection with the flora of eastern North America.

In discussing the species with nongrooved achenes, Professor Fernald criticizes my key, in which I separate *P. pacifica* and *P. occidentalis* from the rest by the petals being "usually over 1 cm. long rounded-obovate," while the others have petals "6–8 mm., rarely 1 cm. long, usually elliptic-obovate." It may be true that I have "never known the full beauty of its large flowers" [*A. litoralis*] and that the given characters do not hold. I did not see the specimens in the herbarium of the New England Botanical Club, although I saw all in the Gray Herbarium. I have never seen any one, however, with such broad rounded petals as are usual in *A. occidentalis*. The latter has usually also broader and more obovate leaflets. Even if *A. occidentalis* and *A. litoralis* should be one species or variety, as you please, and the characters assigned should be found inconstant, the name of the eastern plant should not be *Potentilla pacifica* Howell, for that species was based on *P. Anserina β grandis* T. & G. The type was collected by Scouler and a fair duplicate is in the Torrey Herbarium. If I have not known the eastern plant "in its full beauty," I doubt if Professor Fernald has seen *Potentilla pacifica* in its. At least he did not see it in the Gray Herbarium, for if I remember rightly there was but one fair specimen of it there, shortly before my manuscript went to press.

The first synonym given under *Potentilla pacifica* by Professor Fernald is *P. Anserina groenlandica* Tratt. The type of the latter, collected by Giesecke, I have not seen, but Trattinick's description points evidently to the form of *P. Egedii* Wormskj. with the leaves whitened beneath. Notwithstanding the fact that Dr. Wolf limits *P. Anserina Egedii* to the glabrous form the fact remains that in *Argentina Egedii* (Wormskj.) Rydb. the leaves are whitened beneath or not, even in the same plant. Evidently Dr. Wolf includes in his var. *groenlandica* also the arctic plant from Alaska, which I described as *A. subarctica*. This Professor Fernald reduced to a synonym of *Potentilla pacifica*. Placing the duplicate of the types of *Argentina pacifica*, collected by Scouler, and the type sheet of *A. subarctica* collected by Dr. A. Hollick side by side, few persons would regard them as the same species or at least not as the same variety. *P. subarctica* is characterized by its decidedly turbinate hypanthium and few achenes, characters found only in this species and *Argentina Babcockiana*. In all the others the hypanthium is almost flat. The petals are rarely over 8 mm. long, while in *A. pacifica* they are usually 12–15 mm. long. In the latter the leaves are almost erect while in the other species they are spreading, except when growing among tall grass.

Dr. Wolf's treatment in including all the forms belonging to this genus in but one species, even if he admits several varieties, is unsatisfactory. He even makes the very distinct *P. anserinoides* a variety of *Potentilla Anserina*. My treatment is not satisfactory to Professor Fernald and to several other North American botanists, being too radical; but Professor Fernald, who has tried a kind of compromise, will not be followed by all. There is no doubt but that he knows the New England species better than anyone else, but the name *Potentilla pacifica* Howell does not belong to the eastern plant, and *Argentina subarctica* is not a synonym of it. If he had treated them as varieties I would have been satisfied, for what he and many others call varieties, I call species.

Argentina Anserina (L.) Rydb. and *A. argentea* are represented by numerous specimens in our herbaria. The others are less well represented. In the herbaria of the New York Botanical Garden and Columbia University are found the following. The lists I had from the U. S. Nat. Herbarium and the Gray Herbarium I have mislaid and can not find.

ARGENTINA PACIFICA (Howell) Rydb.

OREGON: Beach, Nestucca, 1901, *Kirkwood 129;* locality not given, *Scouler.*

WASHINGTON: Chehalis County, 1897, *Lamb 1080.*

BRITISH COLUMBIA: Vancouver Island, *Boas.*

ARGENTINA OCCIDENTALIS Rydb.

CALIFORNIA: Suisun, Solano County, June 6, 1903, *Baker 3217;* Albion, Mendocino County, May 1903, *McMurphy 263;* Mendocino County, May 1898, *H. E. Brown 723;* San Mateo County, May 1877, *H. Edwards;* Pacific Grove, April 1903, *Heller 6632;* Lake Merced, San Mateo County, April 1907, *Heller 8441;* Colima, March 1877, *H. Edwards.*

OREGON: Netarts Bay, June 1894, *F. E. Lloyd.*

WASHINGTON: Granville, July 1902, *Conard 349;* Clallam County, June 1900, *Elmer 2525;* Olga, July 8, 1905, *Engberg.*

BRITISH COLUMBIA: Chase River, Vancouver Island, May 1887, *J. Macoun;* Renfrew, 1901, *Rosendahl & Brand 5;* Queen Charlotte Island, 1901, *Boas 28.*

ALASKA: Yes Bay, June 30, 1895, *Gorman 61½*.

It has been collected also on Behring Island, 1891, *Grebritsky*.

ARGENTINA LITORALIS Rydb.

ST. PIERRE: July 14, 1900, *Arsène*.

NEWFOUNDLAND: Channel, July 27, 1901, *Howe & Lang 785;* Barred Island, 1903, *Sornborger;* Placentia, 1894, *Robinson & Schrenk 42*.

LABRADOR: 1894, *Waghorne;* Nain, 1897, *Sornborger 27*.

NOVA SCOTIA: Mabou, August 1906, *C. B. Robinson 247;* Yarmouth, June 1901, *Howe & Lang 1*.

QUEBEC: Seven Islands, August 1907, *C. B. Robinson 689;* Lake Témiscouata, 1887, *Northrop 117*.

MAINE: Gross Island, Maine Coast, 1893, *Harvey;* Seal Harbor, Aug. 20, 1891, *T. G. White*.

MASSACHUSETTS: West Tisbury, August 1895, *Burgess;* East Medford, June 1878, *Perkins;* Ipswich, *Oakes;* Ipswich, June 1874, *Morong*.

NEW HAMPSHIRE: Sumner Falls, Plainfield, July 1900, *Eggleston 1977*.

RHODE ISLAND: Warwick, *Olney*.

ARGENTINA BABCOCKIANA Rydb.

NEW YORK: Westminster Park, 1910, *Miss E. Babcock;* shores of Oneida Lake June 1896, *Mason*.

ARGENTINA SUBARCTICA Rydb.

NORTH WEST TERRITORY, CANADA: 1861–2, *Onion, Kennicott & Hardisty*.

BRITISH COLUMBIA: Macleod Lake, 1879, *Dawson 7221*.

YUKON: Fort Selkirk, July 18, 1899, *Tarleton 132;* Dawson, July 1899, *R. S. Williams*.

ALASKA: Yukon River near Palisades, July 14, 1903, *Hollick;* Yakutat Bay, 1892, *Funston 34*.

The following are referred here doubtfully:

IDAHO: Sand Point, Aug. 24, 1901, *Umbach 428;* Lake Pend d'Oreille, near Hope, 1892, *Sandberg, MacDougal & Heller 937*.

MONTANA: Midvale, June 1903, *Umbach 217*.

ARGENTINA EGEDII (Wormskj.) Rydb.

HUDSON BAY REGION: Cape Jones, 1899, *A. P. Low 63182.*

LABRADOR: Rama, 1899, *Stecker 368.*

GREENLAND: Disco, 1902, *M. P. Porsild 921;* Kuanersuit *1448;* Fiskernaeset, *Holboell.*

ICELAND: Mura, 1888, *C. Sprague Smith.*

COMARUM

As I have stated in a previous paper, Dr. Wolf erroneously referred *Comarum palustre* L. or *Potentilla palustris* Scop. to the section POTENTILLAE TRICHOCARPAE, subsection NEMATOSTYLAE, series SUFFRUTICULOSAE. The ovaries and carpels are perfectly glabrous and the stem is in no way shrubby, the only perennial part being the horizontal creeping rootstock. Furthermore Dr. Wolf has associated with it *Potentilla Salesoviana* Steph. This is a shrubby plant with hairy ovaries and carpels. The only character that would bring them together is the color of the petals, which are purple or rose colored. In every respect *P. Salesoviana* is more closely related to *Dasiphora* than to *Comarum.* It has the shrubby habit of *Dasiphora*, the pinnate leaves, the scarious, sheathing stipules, the flattened anthers, subcordate at the base and dehiscent on the margins, practically the same arrangement of the stamens, and the woolly achenes of that genus. The only characters in which it does not agree with *Dasiphora* are found in the styles and stigmas and the color of the petals. The style is filiform, not clubshaped, and the stigma acutish and obsolete, not expanded, and bluntly 4-lobed, and the color of the flowers is rose or whitish, not yellow. As the color has no value as a generic character, the characters of the style and stigma are the only characters that would keep it out of *Dasiphora.* It should be included in this genus or else be made a distinct genus. The position of the style is lateral in both *Dasiphora* and *Comarum.* *Potentilla Salesoviana* differs from *Comarum*, not only in the characters given above, viz., the shrubby habit and the hairy carpels, but also in the form of the anthers and arrangement of the stamens.

The form of *Comarum palustre* common in North America differs considerably from the typical form of northern Europe.

It is usually much taller and the leaflets are linear-oblong, 5–8 cm. long and only 1–2 cm. wide, obtuse or rounded at the apex and with lanceolate teeth. It was described as *Comarum angustifolium* by Rafinesque. In the European form the leaflets are elliptic or oval, mostly acute at both ends, with broad and ovate teeth. This is also the prevailing form in arctic and subarctic America, but the two forms grade in numerous ways into each other, and *C. angustifolium* can be regarded scarcely more than a variety. So also *C. tomentosum* Raf. (*Potentilla palustris villosa* Lehm.). All grades of pubescence occur from a dense and subvelutinous one to practically none.

DUCHESNEA

Dr. Wolf included *Duchesnea indica* (Andrews) Focke in *Potentilla* and associated it with *P. reptans*, *P. canadensis*, etc. With Dr. Wolf's broad view of genera this was very natural, but I can not see how he could keep out *Sibbaldia* and even *Fragaria* from his *Potentilla*. All three have lateral styles, and *Sibbaldia* is even habitually as close to the typical *Potentillae* as *Duchesnea* is.

FRAGARIA

It is exceedingly hard to draw specific lines in this genus. It is easy to distinguish *F. vesca* or *F. americana* from *F. virginiana* or *F. grandiflora*, for in the former two the achenes are wholly superficial, while in the latter two they are set in deep pits in the fleshy receptacle, but such species as *F. californica* and *F. mexicana* connect the two groups, the achenes being in very shallow pits.

A twelve years' study of the genus since the publication of my Monograph of the North American Potentilleae, had not changed my views, and the recognized species remained practically the same in my new revision in the North American Flora, only that three new species were described, two varieties given specific rank, and *F. multicipita* Fernald and the introduced *F. grandiflora* Ehrh. added. The treatment in my monograph was not followed either by the authors of the Gray's New Manual or by those of the New Manual of the Central Rocky Mountains; and I scarcely expected that it would. The former admits only two species and two varieties as growing in the northeastern United States, while my monograph admitted five species and one variety, and my treatment in the North American Flora admits seven species. *Fragaria canadensis* and *F. Terrae-novae* are both reduced to forms of *F. virginiana*. Concerning *F. canadensis* the following remarks are found: "A form with the pubescence generally more sparing, the hairs on the scape being subappressed, is sometimes distinguished. (*F. canadensis* Michx., in part.)" The first one who in later years took up the name *F. canadensis* Michx. was Dr. N. L. Britton. He was followed by myself. I do not know of anybody else who in print has "distinguished" *F. canadensis* from *F. virginiana*, i. e., pointed out the differences between the two. The plant characterized by us is not a plant with appressed or subappressed pubescence on the scape but one with spreading pubescence. The distinguishing characters given by us are the oblong-conic fruit and the narrower leaflets with shorter petiolules. It is a rare plant and could be a hybrid between *F. virginiana* and *F. americana*, but the well-developed fruit, which is even longer and narrower than in *F. americana*, speaks against it. Besides, Professor Fernald has collected in the lower part of Quebec an entirely different plant, which looks much more like a hybrid between those two species. This plant is intermediate between the two but more like *F. americana* and is apparently sterile, a fact that speaks for a hybrid origin. In the Gray's New Manual the following remark is also found: "Another scarcely separable form has the hairs on both scapes and petioles sparse and subappressed. (*F. terrae-novae* Rydb.)" These characters are true but they are not the only ones. *F. Terrae-novae* has the large flowers of the western *F. platypetala*, the petals being almost twice the length of the sepals, while in *F. virginiana* they are usually about half longer than the sepals. *F. Terrae-novae* is about as distinct from *F. virginiana* as is Fernald's own *F. multicipita*. The difference between *F. Terrae-novae* and *F. multicipita* is that in the former the leaflets are short-petioluled while in the latter they are sessile. The petals of *F. multicipita* are unknown. *F. Grayana* and *F. americana* are regarded as varieties of *F. virginiana* and *F. vesca* respectively. So they were regarded by Dr. S. Watson.

The treatment in the New Manual of the Central Rocky Mountains is rather less satisfactory. *Fragaria bracteata* Heller is made a synonym of *F. americana*. The two resemble each other much in habit, but in the former the sepals in fruit are ascending or merely spreading, while in the latter they are reflexed as in the European *F. vesca*. It would have been better to reduce *F. americana* to a synonym of *F. vesca*. *Fragaria prolifica*, *F. pumila*, and *F. firma* are given as synonyms under *F. ovalis*. *F. firma* is a pure synonym, for when I described it I had no idea that the strawberry collected by Fendler under the number 206 was the type of *Potentilla ovalis* Lehm. Neither *F. prolifica* nor *F. pumila* are glaucous, but bright green. Professor A. Nelson has placed *F. ovalis*, and consequently also these two species in his division "Leaves somewhat glaucous, pubescence of scape and petioles appressed." He placed *F. platypetala* in the division "Leaves not glaucous; pubescence of the scape spreading or reflexed," although that species usually is decidedly glaucous. *F. glauca* is made a variety of *F. ovalis* although its leaves are by no means "thick." Watson's type has thinner leaves than the type of *F. pauciflora* Rydb., which is regarded as distinct. If *F. glauca* had been made a variety of *F. pauciflora* or vice versa, I would not have made any criticism.

The new species proposed in the North American Flora are *Fragaria insularis*, *F. Suksdorfii*, and *F. yukonensis*. *F. insularis* was based on material from Jamaica, supposed to be *F. vesca* introduced, but the plant is much more glaucous and less hairy than the northern European plant, and the sepals in fruit are not reflexed but ascending or spreading. The plant may be an introduced one in Jamaica, but the same plant has been collected in the Azores and Madeira. It may be the same as the *F. vesca* reported from Spain, but of this I am uncertain as I have seen no Spanish material. Lowe in his flora of Madeira* mentions a wild strawberry with the sepals enclosing the fruit. This may have been *F. insularis*.

In our herbaria are found the following specimens of *F. insularis:*

JAMAICA: Bank, Hardware Gap, 1908, *N. L. Britton 1778* and *3324;* Cinchona ("Wild strawberry"), 1906, *Wm. Harris 9216;* vicinity of Cinchona, 1908, *Alexandrina Taylor 4230* (in part);

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* Man. Fl. Madeira 1: 246. 1868.

same locality, 1906, *N. L. Britton 139;* same locality, 1900, *W. N. Clute 228.*

AZORES: Fayal, 1894, *C. S. Brown 77.*

Fragaria Suksdorfii was based on material which I had referred previously to *F. cuneifolia*, but the broadly lanceolate sepals and the decidedly villous fruit distinguish it from that species. The following specimens belong here:

WASHINGTON: Falcon Valley, June 2 and 28, 1883, *Suksdorf 486.*

OREGON: *Wilkes Expedition 440.*

BRITISH COLUMBIA: Meyers Creek, May 5, 1905, *Spreadborough 69948*, is referred here with some doubt, as there is no fruit.

Fragaria yukonensis was described from material originally determined as *F. chiloensis* or *F. glauca*. The type and some other specimens were referred to *F. chiloensis* on account of the thick subcoriaceous leaflets, but the latter lack the fine tomentum mixed with the longer hairs on the lower surface, characteristic of those of *F. chiloensis*. *F. yukonensis* could not be referred to *F. glauca* on account of its thick leaves. In fact it is more closely related to the southern *F. ovalis* which it resembles very closely. It differs, however, in the distinctly petiolulate instead of subsessile leaflets and in the longer bractlets. Besides, *F. yukonensis* is not known outside of the Yukon Territory, and *F. ovalis* not north of Wyoming. The following specimens belong to the former:

YUKON TERRITORY: Lake Lebarge, June 19, 1899, *Tarleton 38;* Rapid City, Aug. 20, 1899, *R. S. Williams;* Ranch Creek, June 8, 1899, *Gorman 1009;* Fifty Miles River, 1899, *A. L. Bolton.*

Fragaria Grayana Vilmorin was restored to specific rank in the North American Flora. It was first described as *F. virginiana illinoensis* A. Gray, under which name it has been best known. It was recognized before Dr. Gray described it, by Price, who recorded it as *F. illinoensis* but gave no description. I have found no specimens in the herbaria from any place east of Indiana and Alabama, although the type was said to have come from western New York. All specimens so named from the eastern states belonged to either *F. virginiana* or *F. grandiflora*, which latter is an escape from cultivation.

Fragaria grandiflora Ehrh., the "pine strawberry," is a native of South America. It is often hard to distinguish it from *F. Grayana*, but the petals are larger, usually over 1 cm. long, the sepals ovate or ovate-lanceolate, the achenes set in shallower pits, and the leaflets thicker. It often resembles closely *F. chiloensis* but lacks the characteristic tomentum of the lower surface of the leaflets. In cultivation are found many crosses between this species and *F. chiloensis* and *F. virginiana*. In the New York Botanical Garden herbarium there are the following specimens of *F. grandiflora*, which were collected far away from dwellings and which were well established at the localities:

NEW YORK: Roadside in woods between Twin Lakes and Mountain Lodge, Adirondack Mountains, July 4, 1906, *Rydberg 7842*.

BRITISH COLUMBIA: Trail, May 19 and June 13, 1902, *J. M. Macoun 63776* and *63777*.

KENTUCKY: Vicinity of Mammoth Cave, May 1899, *Dr. E. Palmer*.

At the same station where the writer collected *F. grandiflora*, he found also the white-fruited *F. vesca*, and the ordinary *F. virginiana*, with a white-fruited form of the latter. The white-fruited *F. vesca* is not uncommon in certain localities from northern New York and Connecticut to West Virginia and eastern Ohio. It is most common in the mountains of Pennsylvania. It is strange that this form should be common and apparently native in a region where the typical *F. vesca* is very rare and is found apparently only as an escape from cultivation. It is questionable if it should not be regarded as a native geographical species even if it originally mutated from *F. vesca*. It is not a form of the native *F. americana*.

The white-fruited form of *F. virginiana* collected in the Adirondacks by the writer and mentioned above, is very interesting. As the white-fruited *F. vesca* and the ordinary red-fruited *F. virginiana* were common along the road and growing together, these white-fruited specimens of *F. virginiana* might be hybrids between the two. They were typical *F. virginiana*, however, in every respect, even to the pitted fruit, except that the latter was white.

SIBBALDIA, SIBBALDIOPSIS, AND DASIPHORA

No essential change has been made in the treatment of these genera since the publication of my monograph of 1898.

DRYMOCALLIS

This genus is exceedingly perplexing as to its numerous and somewhat intergrading forms. It is by no means easy to draw specific lines. As represented in the eastern United States it is easily disposed of, as it is there represented by only one species, *D. agrimonioides* (*Potentilla arguta* Pursh). In the Rocky Mountain region there are at least nine forms which I have regarded as species, and these increase to about two dozen in the Pacific States. In the North American Flora there were admitted in all 28 species. Of these the following were proposed as new: *Drymocallis corymbosa*, *D. foliosa*, *D. pumila*, *D. viscosa*, *D. arizonica*, *D. amplifolia*, *D. oregana*, *D. laxiflora*, *D. albida*, and *D. micropetala*. Besides these, *D. glandulosa monticola* and *D. glandulosa incisa* were raised to specific rank and the name *D. agrimonioides* (Pursh) Rydb. was substituted for *D. arguta* (Pursh) Rydb., as *Geum agrimonioides* both has page priority and was based on the typical form.

Drymocallis corymbosa was described from specimens included in *D. convallaria* in my Flora of Montana. It differs from the original *D. convallaria* in the flat-topped instead of racemiform cyme, the rounded-obovate instead of rhombic-obovate leaflets, and the conspicuously long-hairy stem and petioles.

It is common from Alberta to Colorado, Idaho, Washington, and British Columbia.

Drymocallis foliosa was described from specimens which I had formerly determined doubtfully as *D. glutinosa* Rydb., i. e., *D. valida* (Greene) Piper. It is characterized by its large-leaved inflorescence and its rhombic-obovate coarsely and incisedly toothed leaflets. The following specimens belong to it:

MONTANA: Bridger Mountains, 1896, *Flodman 596*.

WYOMING: Buffalo Fork, 1897, *Tweedy 214;* Encampment, 1901, *Tweedy 4148*.

UTAH: Alta Mountains, 1899, *M. E. Jones 1108*.

Drymocallis pumila was based on some specimens included in *D. rhomboidea* in my monograph of 1898, and some material received later. Although it resembles *D. rhomboidea* in habit, it differs, however, in one essential character, viz., in the styles, which are decidedly fusiform. In *D. rhomboidea* as well as in *D. glabrata* the styles are filiform. Dr. Wolf remarks under *Potentilla rhomboidea* that he has found in "typical and fine specimens" of this species collected by Suksdorf (*no. 742*) the styles to be fusiform. This number of Suksdorf's, as seen below, belongs to *D. pumila* instead. The large flowers would place it near *D. fissa*, but it is a much more delicate plant, the stem leaves are much reduced and the bractlets are elliptic or oval instead of lanceolate or linear. The following specimens belong here:

Oregon: Stein's Mountains, 1901, *Cusick 2571;* same locality, 1901, *Griffiths & Morris 576*, and 1896, *J. B. Leiberg 2508.*

Washington: Mount Paddo, 1885, *Suksdorf 742.*

Nevada: Summit Lake, 1901, *Griffiths & Morris 311.*

Utah: Marysvale, 1894, *M. E. Jones 5375n.*

Drymocallis viscosa resembles much *D. glandulosa* in habit, has the large petals of *D. valida* and *D. fissa* and the bractlets of *D. pumila*, but differs from all in the conspicuous viscidity of the plant. It is known from the type locality only.

Drymocallis arizonica Rydb. resembles closely *D. Hanseni* but differs in the short dense inflorescence and the longer bractlets. It might have been included in that species but it grows in an entirely different region. The following specimens belong to it:

Arizona: Mormon Lake, 1898, *MacDougal 64;* Bill Williams Mountains, 1883, *Rusby 137* and *594.*

Utah: Near St. George, 1877, *Palmer 146.*

Drymocallis amplifolia connects the *D. glandulosa* group with that of *D. Wrangelliana*. It has the habit of the former and the small pale petals of the latter. It is characterized by its large rhombic terminal leaflets, which resemble somewhat those of *D. foliosa*. The latter has very large deep yellow petals. *D. amplifolia* is known from the type station only, from which several specimens have been seen.

Drymocallis oregana was based partly on material included in *D. Wrangelliana* in my monograph and partly on material studied later. The type was collected by Thomas Nuttall and labeled by him *Potentilla oregana.* This name is cited in Torrey and Gray's Flora as a synonym under *P. glandulosa.* It is, however, more closely related to *D. Wrangelliana*, having the same oval sepals, rounded and mucronulate at the apex, and the small petals of the species; but the pedicels are longer, those of the earlier flowers 1–2 cm. long, the infloresence less leafy, and the petals pure yellow instead of ochroleucous. The stem is also usually more conspicuously long-hairy. It is of more northern distribution, ranging from the Mackenzie and British Columbia to Idaho and Oregon, while *D. Wrangelliana* is confined to California. The following specimens belong here:

OREGON: Columbia River, *Nuttall;* near Wimer, 1893, *Hammond 114 A;* base of Mt. Hood, 1894, *F. E. Lloyd;* eastern Oregon, 1898, *Cusick 2159;* Juniper Springs, 1896, *Leiberg 2286.*

IDAHO: About Lewiston, May 27, 1896, *A. A. & E. Gertrude Heller 3130;* valley of Big Potlatch River, June 6, 1892, *Sandberg, MacDougal & Heller 316;* Moscow Mountains, May 30, 1900, *Abrams 663.*

WASHINGTON: Olympic Mountains, August 1895, *Piper 2000;* Wenatchee, May 25, 1899, *Whited 1095.*

BRITISH COLUMBIA: Between Kettle and Columbia rivers, July 19, 1902, *J. M. Macoun 34527, 63786,* and *63787;* Skagit Valley, June 23, 1905, *J. M. Macoun 69938;* Chilliwack Lake, 1901, *J. M. Macoun 34440.*

NORTH WEST TERRITORY: *Franklin.*

When preparing the manuscript of my monograph in 1896, I studied several specimens labeled *Potentilla reflexa* Greene. Thinking these specimens authentic I drew my description of *Drymocallis reflexa* (Greene) Rydb. mainly from these specimens. Among this material was *Coville & Funston 1355*, from which the illustration was made. Having the opportunity to see Dr. Greene's type while preparing the new revision for the North American Flora, I saw my mistake, and the plant described as *D. reflexa* in my monograph appears under the name *D. laxiflora* in the later work. In *D. laxiflora*, as well as in most species of the *D. Wrangelliana* group, the leaflets are rounded-obovate and the plant conspicuously viscid; while in Greene's specimens of *D. reflexa* the leaflets, especially the terminal ones, are rhombic-obovate and the plant scarcely at all viscid. *D. laxiflora* is more closely related to *D. viscida* Parish, but differs in the broader ovate or oval bractlets, the more elongated and slender branches of the inflorescence, and the simple-toothed leaflets.

The following specimens belong to *Drymocallis reflexa:*

CALIFORNIA: Little Green Valley, San Bernardino Mountains, 1904, *R. Hall 7;* Nevada Falls, Yosemite Valley, 1902, *Hall & Babcock 3430.*

For several years there have been in the herbaria of the New York Botanical Garden, of Columbia University, and of the United States National Museum, several specimens resembling in many respects *Drymocallis Wrangelliana* and *D. oregana*, but with minute whitish petals. They could not be included in any of the previously described species. They resemble most closely *D. viscida* Parish, but the petals are white or whitish, not yellow, the plant is less viscid and the bractlets narrower. Besides, *D. viscida* was known only from southern California, and the specimens referred to come from Washington and British Columbia. In the North American Flora these specimens were described under the name *D. albida.* To it belongs the following material:

WASHINGTON: Damp or shady places at Bingen, 1893, *Suksdorf 2209;* Clallam County, June 1900, *Elmer 2526.*

OREGON: Forest Grove, June 3, 1893, *F. E. Lloyd.*

BRITISH COLUMBIA: Chilliwack Valley, July 10, 1901, *J. M. Macoun 34412* and *34441.* Skagit Valley, June 1905, *J. M. Macoun 69939;* Mt. Finlayson, Vancouver Island, June 3, 1887, *John Macoun.*

While collecting in Utah in 1905, the writer discovered another species closely related to the preceding, but differing in the orbicular instead of obovate petals and in the shorter and broader sepals. It was described in the North American Flora under the name *Drymocallis micropetala.* The following specimens belong to it:

UTAH: City Creek Cañon, June 9 and 12, 1905, *Rydberg 6153;* same locality June 9, 1883, *Leonard 105;* Red Rock Cañon, June 11, 1905, *Rydberg 6074.*

When preparing the manuscript for my monograph in 1896, I had not seen any specimens that agreed with Dr. Greene's description of *Potentilla lactea*. As most of the characterization of this species, according to Dr. Greene's own statements, were drawn from a "flower painting," the species was to my mind very doubtful. I have since seen several species from central and southern California which agree very well with Dr. Greene's description. These specimens resemble much in habit my own *Drymocallis gracilis*, but the petals are much smaller, scarcely exceeding the sepals, the plant is smaller and less viscid, and the stem leaves usually reduced. To *Drymocallis lactea* belong:

CALIFORNIA: Meadows above Bear Valley, July 23, 1906, *H. M. Hall 7562;* San Bernardino Mountains, Aug. 1, 1906, *Hall 7613;* vicinity of Hog Ranch, Yosemite National Park, July 1902, *Hall & Babcock 3391;* Griffins, July 1902, *Elmer 3978;* San Jacinto Mountains, July 1901, *Hall 2355;* Sawtooth Peak, 1904, *Hall & Babcock 5686.*

Dr. Wolf's treatment of the species belonging to this genus is altogether unsatisfactory. Of course he includes them in the genus *Potentilla*. *Drymocallis pseudorupestris* is made a variety of the European *Potentilla rupestris*, *D. convallaria* is made a variety of *P. arguta; D. lactea* is only mentioned under *Potentilla rupestris americana; D. rhomboidea* and *D. cuneifolia* are admitted as species; the rest are all bunched under *Potentilla glandulosa. D. incisa* and *D. Hanseni* are regarded as mere forms of *P. glandulosa genuina. D. fissa* appears under the name *P. glandulosa fissa* Th. Wolf, and *D. ashlandica* is made a mere form of the same. *D. valida* becomes *P. glandulosa glutinosa* and *D. glabrata* is regarded as a form thereof. *D. Wrangelliana* and *D. reflexa* are also regarded as varieties of *Potentilla glandulosa*. This treatment is at variance with the way the plants have been treated in this country, not only by Dr. Greene and myself, who have done the most work on the genera of Potentilleae, but by more conservative botanists. Professor Aven Nelson* regards *D. convallaria*, *D. pseudorupestris*, *D. fissa*, and *D. glutinosa* (= *D. valida*) as good species. These were the only Rocky Mountain species known besides *D. agrimonioides* (= *D. arguta*) and *D. glandulosa* until my revision in the North American Flora. Howell* admits *Potentilla glutinosa*, *P. ciliata* (= *D. ashlandica*), *P. fissa*, *P. glandulosa*, *P. Wrangelliana*, *P. reflexa*, and *P. rhomboidea*. Piper† admits *Drymocallis rhomboidea*, *D. pseudorupestris*, *D. convallaria*, *D. valida*, *D. glandulosa*, *D. glabrata*, and *D. Wrangelliana*. Blankinship‡, who belongs to the conservative school, admits *Potentilla fissa* and *P. rhomboidea* besides those found in my Flora of Montana, viz., *Drymocallis arguta*, *D. convallaria*, *D. pseudorupestris*, *D. glutinosa*, and *D. glandulosa*. Heller§ admits all the species included in my monograph of 1896. Hall ‖ admits *Potentilla lactea* and includes *Drymocallis viscida* Parish under the name *Potentilla glandulosa nevadensis*. Jepson,¶ who is very "conservative," on the contrary admits but one species, viz., *Potentilla glandulosa*. The plant described by him, however, is not *P. glandulosa* Lindley, but *P. Wrangelliana*.

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* New Manual of Botany of the Central Rocky Mountains.

CHAMAERHODOS

The American species of this genus has been regarded as identical with the Siberian *Chamaerhodos erecta* (L.) Bunge. Nuttall, one of America's most acute botanists, was the first to see the difference between the American and the Asiatic plant, and named the former *Chamaerhodos erecta parviflora*. Pickering regarded it as a distinct species, but his name *C. Nuttallii* was not properly published before the appearance of my revision in the North American Flora. In Torrey and Gray's Flora it appears as a synonym. The American plant has usually smaller flowers, the branches of the flat-topped inflorescence are strongly ascending, the pedicels erect or nearly so, and even in fruit scarcely exceeding the flower in length, while in *C. erecta* they are ascending and much longer.

New York Botanical Garden.

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* Flora of Northwest America.

† Flora of Washington.

‡ Montana Agricultural College Studies, 1, part 1.

‡ Catalogue of North American Plants, edition 2.

‖ Botanical Survey of San Jacinto Mountains.

¶ Flora of Western Middle California.

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Vol. 7, part 1, issued Oct. 4, 1906. Ustilaginaceae, Tilletiaceae.

Vol. 7, part 2, issued March 6, 1907. Coleosporiaceae, Uredinaceae, Aecidiaceae (pars).

Vol. 25, part 1, issued August 24, 1907. Geraniaceae, Oxalidaceae, Linaceae, Erythroxylaceae.

Vol. 9, parts 1 and 2, issued December 19, 1907, and March 12, 1908. Polyporaceae. (Part 1 no longer sold separately.)

Vol. 22, part 3, issued June 12, 1908. Grossulariaceae, Platanaceae, Crossosomataceae, Connaraceae, Calycanthaceae, Rosaceae (pars).

Vol. 22, part 4, issued Nov. 20, 1908. Rosaceae (pars).

Vol. 17, part 1, issued June 30, 1909. Typhales—Poales.

Vol. 16, part 1, issued Nov. 6, 1909 Ophioglossales—Filicales.

Vol. 9, part 3, issued Feb. 3, 1910. Boletaceae, Chantereleae, and Lactarieae (pars).

Vol. 25, part 2, issued June 3, 1910. Tropaeolaceae—Malpighiaceae.

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PHYCOLOGICAL STUDIES—V. SOME MARINE ALGAE OF LOWER CALIFORNIA, MEXICO

By MARSHALL AVERY HOWE

NEW YORK
1911

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL CLUB 38: 489-514. *pl. 27-34.* 1 D 1911

[From the BULLETIN OF THE TORREY BOTANICAL CLUB, 38: 489-514, *pls* 27-34. 1911.]

Phycological studies—V. Some marine algae of Lower California, Mexico

MARSHALL AVERY HOWE

(WITH PLATES 27-34)

So far as the writer is aware, the only paper in which the algae of Lower California (Baja California) have been described or noted is one by M. Paul Hariot, published in 1895.* In that paper seven species, five marine and two from fresh water, were recorded; of the seven, three were described as new. In our list published below, twenty-four species are definitely named and three others have been referred simply to genera, and as these are all different from the seven recorded by M. Hariot, we have now, for the beginnings of our knowledge of the algal flora of Lower California, some evidence of the existence there of at least thirty-four species. The fact that none of the collections thus far made duplicates any of the others even as to a single species may possibly be taken as an indication that the algal flora of this region, when better known, may prove to be rich and varied. The present paper is based primarily on a collection made at La Paz on February 28, 1911, by Señor G. J. Vives, and submitted to the writer for determination by the late Dr. Pehr Olsson-Seffer, chief of the botanical section of the Departamento de Exploración Biológica of the agricultural bureau of the Mexican government. Señor Vives' collection includes eighteen species, of which seven are described below as new. In addition to this gathering, a collection of six species made in February, 1904, by Dr. D. T. MacDougal, in San Felipe Bay, 500 miles or more north of La Paz and near the head of the Gulf of California, is reported upon; of these we have ventured to propose one species as new. In the list are included also three other species from La Paz, which came to the herbarium of the New York Botanical Garden in 1904 through the purchase of the herbarium of Dr. C. L. Anderson, of Santa Cruz, California.

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* Algues du Golfe de Californie recueillies par M. Diguet. Journal de Botanique 9: 167-170. 1895.

CHLOROPHYCEAE

ULVA FASCIATA Delile, Fl. Égypte 153. *pl. 58. f. 5*

La Paz, *Vives 12* and *24*.

The specimens appear to approach Setchell's forma *expansa*. The thallus is only 35–55μ thick and the cells in the older parts are often subquadrate in cross section, but in these respects the plants do not differ much from the New York Botanical Garden copy of Phyc. Bor.-Am. LXXVII, distributed as *Ulva fasciata* forma *expansa* Setchell.

ULVA LACTUCA RIGIDA (Ag.) Le Jolis, Liste Alg. Mar. Cherbourg 38. 1863

Ulva rigida Ag. Sp. Alg. 410. 1822.

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

Thallus 36–42μ thick, brownish, becoming almost livid.

(?) ENTEROMORPHA INTESTINALIS (L.) Grev. Alg. Brit. LXVI, 179. 1830

La Paz, *Vives 16*.

Inconspicuously proliferous near base, the proliferations often short and spinescent; membrane 40–54μ thick; cells mostly 13–25μ in diameter, rather thin-walled, in cross section of thallus about 40μ long, exclusive of outer walls; attached to the stalks of a Sertularian (?) animal.

ENTEROMORPHA LINZA (L.) J. Ag. Till Alg. Syst. 3: 134. 1882

Ulva Linza L. Sp. Pl. 1163. 1753.

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

The plants are small and unusually narrow (4–10 cm. long, 1–6 mm. wide) and their margins are plane or nearly so. They are rather difficult to distinguish from *Enteromorpha compressa* forma *simplex* Wittr. & Nordst. (Alg. Exsicc. *326*), but the two layers of the thallus appear to separate less easily in the upper broader parts, the marginal cells in a cross section are more elongate and more radiately disposed, and the cells in general are more distinctly in lines in the lower parts. No trace of branching has been observed.

Cladophora MacDougalii sp. nov.

Rather stout, coarse, and rigid, in strict tufts, dark- or yellowish-green, 10–17 cm. high; main filaments 135–310μ in diameter, sparingly dichotomous below the middle of the tufts; branching in median and upper parts lateral, the branches erecto-patent, secund, occasionally alternate, or very rarely opposite, becoming more or less secund-pectinate toward apices, the main axes commonly excurrent beyond the last lateral branch as rather rigid tapering prolongations 10–40 cells long; the ultimate lateral branchlets 75–110μ in diameter, about one half the diameter of the filaments from which they spring, usually 3–7 cells long, in most cases gradually tapering from near the base, subacute or blunt, commonly rather rigid; cells in extreme basal parts 6–15 times as long as broad, in median and upper parts 1–4 (mostly 1½–2½) times as long as broad, usually a little constricted at the septa and appearing quite strongly constricted when dry. [PLATE 33, FIGURE 7.]

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

The present species is evidently allied to both *Cladophora Hutchinsiae* (Dillw.) Kütz. and to *C. ovoidea* Kützing, but is not satisfactorily identified with either. In size it resembles *C. Hutchinsiae* (type from Ireland), but it is more rigid and much more strict in habit of growth; dichotomies are rare above the middle of the tuft, while in *C. Hutchinsiae* they commonly persist almost to the apices; the ultimate lateral branchlets in *C. MacDougalii* are much more slender than the axes from which they arise, having usually, in their middle parts at least, only half the diameter of the parent filament, while in *C. Hutchinsiae* the corresponding branchlets are as a rule only slightly less stout than the filament from which they spring; in *C. MacDougalii* ultimate lateral branchlets of 1 or 2 cells in length are extremely rare, 5 to 7 cells being the prevailing number, while in *C. Hutchinsiae* branchlets of 1 or 2 cells are very common.

Cladophora ovoidea Kütz. (type from the island of Föhr, North Sea) has, according to its original describer, primary filaments that are 1/20‴ (112μ) thick and upper branches 1/40‴ (56μ) thick,* and his later† figures of the species bear out this general description of its dimensions, though one of the cells of the main filament figured, according to the magnification given, reaches a diameter of 150μ. We have seen no European specimens of *C. ovoidea*, but are unwilling at the present time to identify with this species a Lower California plant with filaments and branches averaging twice as thick as those of the plant described and figured by Kützing, and with filaments so little constricted at the septa (in a soaked-out condition, at least) that no one would think of describing any of the cells as "ovoid" (Kützing, Phyc. Gen. 266). Also, according to Kützing's figure, the branching in *C. ovoidea* is more fasciculate than in *C. MacDougalii*, the ultimate lateral branchlets are less tapering and less rigid, and the main axes do not show the long-excurrent prolongations of the Baja California species.

CLADOPHORA TRICHOTOMA (Ag.) Kütz. Sp. Alg. 414. 1849
Conferva trichotoma Ag. Syst. Alg. 121. 1824.

Fragments referable to this or to some closely allied species are mixed in with a specimen of *Centroceras clavulatum* from La Paz in the herbarium of the New York Botanical Garden, ex herb. C. L. Anderson, collector unknown. The intertangled filaments are 190–300μ in diameter, di- or trichotomous at nearly every joint, with occasional short and blunt lateral branches 1–3 cells long and of scarcely less diameter than the parent filament; cells mostly 2–5 times as long as broad, usually constricted at the septa, the upper often ovoid. The plants are rather coarser and the cells are relatively shorter than called for by Kützing's description and figures for the species in question.

HALIMEDA DISCOIDEA Decaisne, Ann. Sci. Nat. II. **18**: 102. 1842.
Howe, Bull. Torrey Club **34**: 495–500. *pl. 25. f. 11–20; pl. 26.* 1907

La Paz, *Vives 4*.

The segments are here mostly quadrangular-oblong or cuneate-obovoid, the longer axis being nearly always in the longitudinal or vertical plane rather than in the transverse. As in Hawaiian specimens, the utricles of the subcortial layer are smaller and less bullate than in the plants of southern Florida and the West Indies, but they have a maximum diameter of 68–175µ and are always much larger than the peripheral utricles; they also form a compact flat-topped stratum, very different from anything that occurs in *H. Tuna*. The firmly coherent, often interlocked and fusing peripheral utricles, and the light calcification, together with the characters previously mentioned, leave no doubt as to the correctness of identifying the plants with *H. discoidea*.

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* Kützing, Sp. Alg. 393. 1849.

† Kützing, Tab. Phyc. **3**: 26. *pl. 92. f. 1.* 1853.

The finding of a *Halimeda* on the coast of Lower California is of particular interest in extending our knowledge of the distribution of this genus. So far as is known to the writer, the only previous record of the occurrence of a *Halimeda* on the Pacific coast of the American continents is that given by Miss Ethel Sarel Barton [Mrs. Gepp] in her monograph of "The Genus *Halimeda*," where, under the stations for *Halimeda Tuna*, is given "Payta, Peru, *Sinclair*."

CODIUM TOMENTOSUM (Huds.) Stackh. Ner. Brit. XXIV. 1797

Fucus tomentosus Huds. Fl. Angl. 584. 1778.

La Paz, *Vives 8* and *14*.

The specimens from Baja California communicated under the above numbers are a little more rigid than is usual in *Codium tomentosum*, and the walls of the peripheral utricles are for the most part conspicuously thickened at their apices, being there commonly 8–27µ thick, though occasionally only 3–4µ. We find no trace of a mucro even in the younger parts and can discover no sufficient ground for considering the plants distinct from *C. tomentosum*, with which they agree well in size and habit. The thickened apices of the utricles are slightly suggestive of those of the Australian *Codium galeatum* J. Ag., but they are not contracted-umbonate as in that species and the plants have not the size and habit of that species. Certain Jamaican specimens which we have referred to *C. tomentosum*, sometimes have the apical walls of the peripheral utricles even more thickened than in these plants from Lower California, and European specimens occasionally show the same character. In this latter connection may be mentioned especially Hohenacker's Meeralgen, *no. 497*, from Cherbourg, distributed as *Codium tomentosum* var. *proliferum*, and *no. 35* of Mary Wyatt's Algae Danmonienses. *No. 628* of the Phycotheca Boreali-Americana, from La Jolla, California, issued as *Codium Lindenbergii* Binder, is, so far as we have seen it, a somewhat coarser and less copiously branched plant than those from Baja California, and its peripheral utricles are scarcely thickened at the apex. If it had been collected in England, we suspect that it would have been referred to *Codium tomentosum* without serious question. The plants issued under this number, so far as we have seen them, scarcely show evidence of flattening beyond that resulting from pressure. They are certainly very different in habit from plants of the South African *C. Lindenbergii*, which is conspicuously flattened throughout, with the possible exception of the stipe, and has segments often 2–3 cm. wide. The utricles of the Baja California plants, it may be remarked, are clavate, obovoid-clavate, truncate-clavate, or pestle-shaped, 82–165μ in greatest width, and 380–500μ long.

Codium decorticatum (Woodw.) comb. nov.

Ulva decorticata Woodw. Trans. Linn. Soc. **3**: 55. 1797.
Codium elongatum Ag. Sp. Alg. **1**: 454. 1822.

La Paz, *Vives 17*.

The plants reach a length of 5 dm., are sparingly branched, and, in the older, are flattened now and then under the dichotomies; the peripheral utricles are obovoid or broadly clavate, thin-walled, obtuse, 137–520μ in maximum width, and 500–700μ long.

The identity of Woodward's *Ulva decorticata* with *Codium elongatum* was admitted by C. Agardh himself at the moment of proposing the name *C. elongatum* and has been acknowledged also by Kützing. We have not seen Woodward's specimen and do not know that it exists, but his lengthy and rather detailed description can leave students of *Codium* in no reasonable doubt as to what he actually had. His failure to recognize its affinity with "*Fucus tomentosus* Huds." and his statement that "in substance it differs from all other known marine Algae" appear a little strange, yet from Goodenough and Woodward's paper on the

British Fuci, published in the same volume of the Transactions, it would seem that these authors were not very familiar personally with "*Fucus tomentosus*" and, furthermore, that they considered it "very doubtful whether it may not belong to the genus *Ulva*." Agardh doubtless thought that he was improving on the specific name in substituting *elongatum* for the inapt and more or less misleading *decorticatum*, but under the prevalent rules of procedure of the present day, there seems to be no sufficient reason for ignoring what is apparently the oldest tenable specific name.

Harvey and some other writers have doubted the specific distinctness of what has been known as *Codium elongatum*, considering it a form of *C. tomentosum*. But in its usual form it is so different from *Codium tomentosum*, and ambiguous conditions are so few that it seems worth while, for the present at least, to maintain its specific rank. Its elongate and sparingly branched habit, its more or less pronounced flattened expansions below the dichotomies, and its larger utricles, are commonly quite sufficient to distinguish it from *C. tomentosum*. In this connection, however, it is of interest to note that the apparently original specimens of *C. elongatum* Ag., preserved in the Agardh herbarium, do not show particularly large utricles (they are 110–225μ in greatest width), and the dilations under the dichotomies are not remarkably pronounced, reaching a width of scarcely 2 cm. In specimens of our collecting in Bermuda the dilations sometimes have a width of 10 cm. or more.

PHAEOPHYCEAE

COLPOMENIA SINUOSA f. TUBERCULATA (Saunders) Setch. & Gard. Univ. California Stud. Bot. **1**: 242. 1903

Colpomenia tuberculata Saunders, Proc. California Acad. Sci. III. **1**: 164. *pl. 32. f. 1–3.* 1898.

La Paz, collector unknown. The specimens were sent to Dr. C. L. Anderson from the California Academy of Sciences, with the information that they had been used for packing. The brown, coriaceous thallus forms mats 10–20 cm. wide. Some parts of the thallus are nearly smooth, some parts bear wartlike excrescences, and others are drawn up into subconical, bullate, or finger-shaped processes sometimes 1–2 cm. long.

COILODESME ———?

La Paz, *Vives 18c.*

Poor and fragmentary material, but it seems to be closely related to *Coilodesme californica* (Rupr.) Kjellm.

SARGASSUM ———?

La Paz, *Vives 18d.*

A fragment of a plant of the *Eusargassum* section, with thin linear-lanceolate serrate-ciliate leaves 6–8 cm. long and 7–12 mm. in greatest width; cryptostomata inconspicuous or wanting; leaf margins here and there approaching a biserrate condition.

SARGASSUM ———?

La Paz, *Vives 1.*

A single plant a meter or more in length, sterile or with very immature receptacles. Resembling *Vives 18d*, but the lanceolate or linear-lanceolate leaves (2–9 cm. long, 5–14 mm. in greatest width) have much more conspicuous cryptostomata. The texture of the leaves is thin-membranous and the margins are irregularly serrate, the teeth often terminating in soft somewhat cilium-like points. The vesicles are subglobose and muticous, the largest attaining a diameter of 6–8 mm. Both this and 18*d*, which is possibly a form of the same thing, are quite different from *Sargassum Liebmanni* J. Ag. and *S. Agardhianum* Farl., which, so far as we are aware, are the only two species of *Sargassum* that have thus far been described from the Pacific coast of North America. The plants suggest broad-leaved forms of *S. Filipendula* (Ag.) J. Ag., but we are unwilling to refer them to that species and unwilling also, with the material at hand, to propose a new specific name in a genus in which more than two hundred more or less imperfectly understood species have already been proposed.

In the herbarium of the New York Botanical Garden (ex herb. C. L. Anderson) are four fragments of a *Sargassum* from La Paz, Baja California, which have leaves resembling those of *Vives 1* in form, size, margin, and cryptostomata, but are rather more coriaceous. One of the specimens is accompanied by a long (12 cm.) lax leafless panicle of receptacles. The panicle is detached but probably belongs with the accompanying stem and leaves.

PADINA DURVILLAEI Bory, Dict. Class. Hist. Nat. **12**: 591. 1827; Voy. Coquille, Bot. Crypt. 147. *pl. 21. f. 1.* 1828

La Paz, *Vives 5*, *13*, and *15*.

No. 13 of the material communicated consists of one young specimen 5–6 cm. high and one larger, apparently mature but sterile specimen about 12 cm. high, with its main, flabellate or cuneate-flabellate lobes 10–12 cm. broad. The thallus is somewhat coriaceous and multistratose except at the extreme margin; it is for the most part 8–12 cells thick, though towards the base it may become as much as 18 cells thick. Specimens of *P. Durvillaei* in the Muséum d'Histoire Naturelle of Paris, marked "de la Concepcion, Chili, par Durville, 1825, . . . petits individus," show a thickness of 8–10 cells in median portions.

No. 5 is similar to the older plant under no. 13, but is smaller and more dissected. No. 15 consists of fragments distorted by bearing the eggs of some marine animal.

PADINA sp.

La Paz, *Vives 3*.

A much thinner and rather more calcified plant than no. 13 (*P. Durvillaei*). The single specimen gives the impression of having been semiprostrate when growing, though this appearance may be due in part to the way the specimen has been pressed and dried. The plant is 6–7 cm. long or high and its rounded-flabelliform lobes are 6–7 cm. broad. The thallus is 3 cells thick from the base to the rolled margin, which is bistratose. The surface cells are oblong, 22–68μ × 22–27μ, while in *P. Durvillaei* they are quadrate and oblong and about 13–28μ in diameter. The plant represents possibly an undescribed species, but as several poorly understood species have been proposed in the genus and as our material is sterile, we would hardly venture at this time to suggest a new specific name.

Dictyota Vivesii sp. nov.

Densely cespitose, stupose at base, 7–9 cm. high, 135–160μ thick (240μ at base), collapsed and thin on drying, somewhat regularly 3–6 times dichotomous below, the branches then rather closely 3 or 4 times subflabellately or subpinnately dichotomous, sinuses mostly rather acute, margins very entire or slightly undulate; main segments oblong or obcuneate, 3–8 mm. broad, diminishing conspicuously in length and width in the apical subdivisions, the terminal segments mostly 1–2 mm. wide, their dichotomies forming angles of about 45°, the apices obtuse or subacute; surface on drying mostly smooth or slightly and irregularly reticulate in the older parts; cortical cells nearly uniform in size and color, $19–65\mu \times 11–27\mu$, 1–3 times longer than broad; interior cells $96–250\mu \times 55–110\mu$, very thin-walled and often inconspicuous when viewed through the cortex, the walls perpendicular to the surfaces mostly only $1–2\mu$ thick ($10–12\mu$ in basal parts), collapsing on drying; tetrasporangia forming small scattered inconspicuous sori. [PLATE 27.]

La Paz, *Vives 2* (type) and *18e*.

Dictyota Vivesii is perhaps most nearly related to *D. Bartayresiana* Lamour., but cannot well be identified with that West Indian species. It is more cespitose in habit of growth than *D. Bartayresiana*, more stupose at the base, less regularly dichotomous towards the apices, rather broader in its broadest parts and more conspicuously dwindling in width as the ultimate segments are approached, the axils (the upper at least) are more acute and the segments less patent or divaricate, the apices are less acute, and both the cortical and the interior cells are for the most part narrower and the cortical cells overlying the septa and lumina of the interior cells show scarcely any of that differentiation in form and translucency that led J. Agardh to describe *D. Bartayresiana* as "fenestrate"; the walls of the interior that are perpendicular to the surface are remarkably thin, being usually only $1–2\mu$ thick, while those of *D. Bartayresiana* are ordinarily $3–7\mu$ thick; whether wholly as a result of this thinness of the walls, or in part as a result of the treatment the specimens may have received, we do not know, but the interior cells of our dried specimens of *D. Vivesii* are so completely collapsed that they do not at all regain their natural form on being soaked with water, though they revive tolerably well on being treated with a solution of potassium hydrate. The smoothness of most parts of the surface of *D. Vivesii*, in its dried state, may be due in some measure to the presence, in many portions of the thallus, of a layer of small oval diatoms so closely adherent and so evenly disposed that their presence is revealed only by the higher powers of the microscope. The tetraspores of *Dictyota Vivesii* occasionally, as in most other species of the genus, germinate precociously or while still attached to the thallus, so that the surface appears inconspicuously proliferous here and there.

The only Dictyotas hitherto recognized from the Pacific coast of North America are, so far as we are aware, *Dictyota crenulata* J. Ag. from St. Augustin, Mexico, and *D. Binghamiae* of California. Of these, *D. crenulata* is characterized by strong marginal teeth, which are wholly lacking in *D. Vivesii;* by elongate or lingulate, broadly obtuse or subtruncate terminal segments, which are as broad as any part of the thallus; by a cortex that is for the most part conspicuously fenestrate in the Agardhian sense; by thicker-walled cells; and by a usually reticulate surface when dry.

Dictyota Binghamiae is a coarser, thicker (275–500μ), more regularly dichotomous plant, with segments usually broader and their width better sustained towards the apices; its surface is beautifully reticulate when dry, and under the microscope the cortical cells, in most cases, show very clearly the differentiation in form and translucency that suggested the term "fenestrate" to J. Agardh. The cortex, too, of *D. Binghamiae*, towards the margins and in the older parts, often shows two or more layers of cells,—a character that is presumably responsible for its former identification with *Glossophora Kunthii.* The walls of the interior cells, that is, the walls that are perpendicular to the surface, are very firm and thick (5–30μ).

RHODOPHYCEAE

PORPHYRA LEUCOSTICTA Thuret in Le Jolis, Liste Alg. Mar. Cherbourg 100. 1863

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

This species, so far as we are aware, has hitherto been attributed, for the Pacific coast of America, only to Monterey Bay, California.* The Gulf of California specimens differ a little in color from most European and eastern American plants, tending rather more to brownish and blue-purple shades.

The thallus is about 40μ thick, surface jelly 8–11μ thick; plants monoecious; antheridia in spots and streaks adjoining sporocarps, both unmixed with vegetative cells; carpospores 8; spermatia 64; thallus disintegrating and deliquescing when dried specimens are soaked out with fresh water.

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* Hus, H. T. A. Zoe **5**: 63. 1900; Proc. California Acad. Sci. III. **2**: 202. 1902.

Scinaia latifrons sp. nov.

Thallus gelatinous-membranaceous, thin, complanate, 10–16 cm. long, 4–7 times dichotomous, not constricted, the segments 5–12 mm. broad (when dry), axils rather acute and branches somewhat patent, costa obsolete, apices obtuse or shortly and bluntly apiculate: cystocarps 0.17–0.32 mm. in diameter, marginal, mostly confined to areas 1–2 mm. broad measured from the margin; carpospores irregularly ovoid or oblong, 10–22μ long. [PLATE 28 and TEXT FIGURE 1.]

La Paz, *Vives 6*, *11a* (type), and *20c*.

The material submitted consists of eight specimens, all of which are amply distinct from *S. furcellata undulata*, with which it grows associated, differing in the much broader thinner flattened membranous thallus and the marginal cystocarps. Though having a pronounced "Halymenioid" habit, the plants have the peculiar and characteristic vegetative structure and cystocarps of *Scinaia*. If aberrant in any particular it is in the absence of any costa or well-defined axile strand that can be clearly recognized even in a cross section, contrasting in this respect with *S. furcellata undulata*, with which it is associated and in which a compact axile strand is very manifest in cross section at least. The thallus of *S. latifrons*, even when sections of the dried material have been treated with potassium hydrate, shows a thickness of only 80–135μ, but it is probable that fresh or liquid-preserved specimens would have a greater thickness. The thallus appears to be the thickest towards the margins, whether the margins bear cystocarps or not. A cross section of the stipe shows a compact medullary mass of filaments with a special axile strand only slightly indicated. The hyaline peripheral cells of the thallus have a height of 27–36μ, averaging considerably higher than in the associated *S. furcellata undulata*. The color of dried specimens of *Scinaia latifrons* is a light brownish rose, while that of *S. furcellata undulata* is a dingy or purplish brown.

Among the described species, varieties, and forms of *Scinaia*, *S. latifrons* is apparently most nearly allied to *S. furcellata* forma

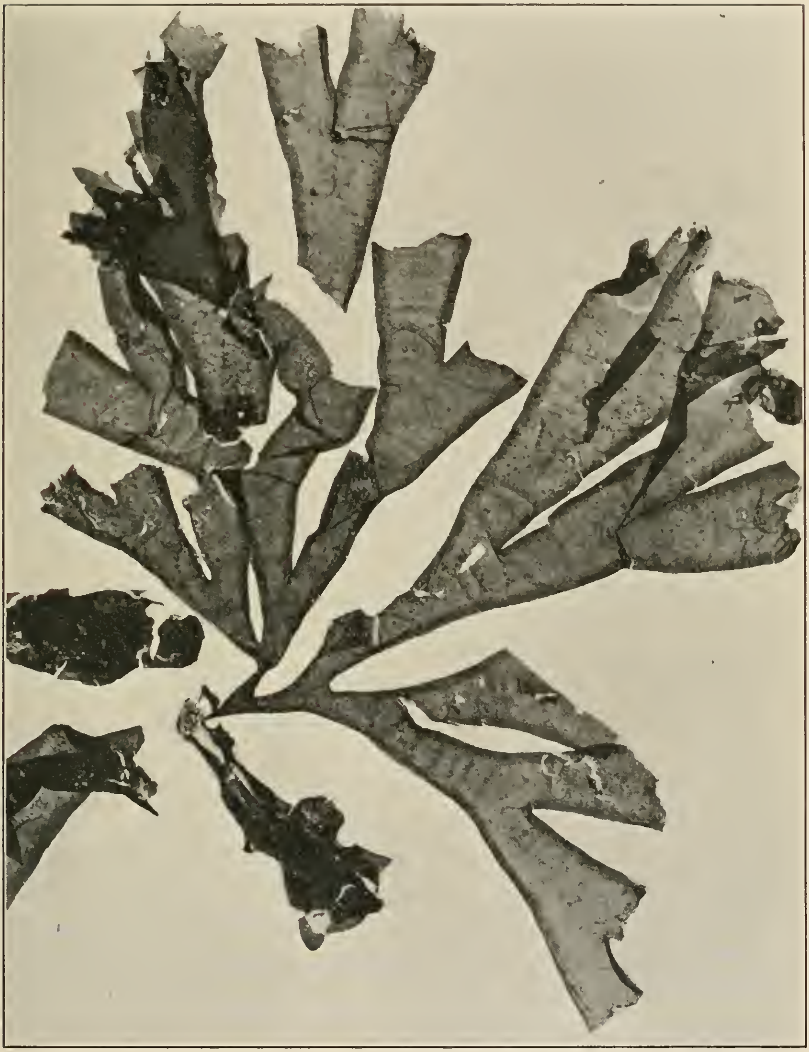

FIGURE 1. *Scinaia latifrons* M. A. Howe

(La Paz, *Vives 11a*), natural size. The dark spots showing near the margins are mostly cystocarps, but those in median parts are due to epiphytic growths. See also PLATE 28, which shows the type specimen somewhat reduced.

complanata Collins (Phyc. Bor.-Am. *836*) from Florida, but in that the segments are only 2 mm. instead of 5–12 mm. broad and the cystocarps are not confined to the margins.

SCINAIA FURCELLATA UNDULATA (Mont.) J. Ag. Sp. Gen. et Ord. Alg. 2: 422. 1852

Ginnania undulata Mont. Voy. Bonite, Bot. Crypt. 59. *pl. 145. f. 3.* 1844.

La Paz, *Vives 11d* and *20b*.

This differs from *Scinaia latifrons* as noted above.

The two specimens seen have a length of 10–14 cm. and their segments are about 2 mm. wide.. The segments are probably terete or nearly so in life, though they do not regain that form on being soaked out.

The specimens appear to agree essentially with those occurring on the coast of California as far north, at least, as Santa Cruz. The peculiarities of the Pacific Coast plant seem insufficient to separate it specifically from *Scinaia furcellata*.

(?) GIGARTINA CHAMISSOI (Mert.) Mont. Voy. Bonite, Bot. Crypt. 71. 1844

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

The plants are rather small (3–8 cm. long), but are probably nearer to *G. Chamissoi* than to any other described species. The main segments are 2–10 mm. broad and are less regularly pinnate and less elongate than in *G. Chauvinii* (Bory) Mont. The narrower specimens resemble certain broader conditions of *G. Teedii* (Roth) Lamour. The faces of the segments are smooth or sometimes lightly papillate and the only cystocarps seen are marginal. The branching is much more pinnate than in any of the California specimens that we have seen referred to *G. papillata* (Ag.) J. Ag.

Anatheca dichotoma sp. nov.

Thallus cuneate-attenuate at base, subcartilaginous or somewhat gelatinous, reaching a length of 25 cm., mostly 7–11 times dichotomous and with occasional marginal proliferations, segments 6–12 mm. in greatest width, tapering to 1 or 0.5 mm. in the ultimate divisions, 0.66–1.3 mm. thick, axils rounded, branches erecto-patent, apices acuminate, almost terete or conic-terete; the filamentous or rhizoidal medulla bordered by mostly two irregular series of large cells 240–340μ in maximum diameter in cross section, their walls rather firm, not gelatinizing much in fresh water or glycerin, remaining about 6–15μ thick, the large cells passing somewhat abruptly into the small cells of the outer cortex; the zonate sporangial tetrads irregularly ovoid, 55–85μ in long diameter; other parts not seen. [Plate 29.]

La Paz, *Vives 7* (type), *11c*, *18b*, and *20a*.

Although our specimens are either sterile or tetrasporic, we have little hesitation in considering this plant a close relative of the one from Whidbey Island, Washington, distributed in the Phycotheca Boreali-Americana, *no. 932*, as "*Anatheca furcata* Setchell & Gardner ms." and afterwards described and figured in Univ. California Publ. Bot. 1: 310. *pl. 23. f. 39; pl. 24. f. 41.* 1903. However, we are at present unwilling to regard them as forms of one species. *Anatheca furcata* reaches a width of 2–3 cm., while *A. dichotoma* is mostly only 1–7 mm. wide; it is once to thrice forked, while *A. dichotoma* is commonly 8–10 times forked; *A. furcata* also has a darker red color, a longer, more attenuate stipe, and its cell walls are more inclined to gelatinize on being soaked out with fresh water, which fact is doubtless responsible for giving specimens a less rigid and cartilaginous habit than those of *Anatheca dichotoma*.

Gracilaria Vivesii sp. nov.

Thallus membranaceous, complanate, regularly and flabellately dichotomous (4 or 5 times forked in specimens seen), attaining a length of 14 cm., 250μ thick in younger parts, becoming 500–700μ below, broadly cuneate or inversely deltoid at base; the lower segments subquadrate or cuneate-oblong, 8–20 mm. broad below, becoming 10–35 mm. broad under the dichotomies; segments of the two ultimate dichotomies considerably narrower, oblong or somewhat linear-oblong, 7–10 mm. wide, diminishing to 4–6 mm. in the terminal; margins entire, axils rounded, dichotomies patent or occasionally somewhat divaricate, apices rounded-obtuse, color a vinous- or coralline-red fading to light greenish pink; medulla composed of two or three irregular series of subglobose, ovoid or somewhat flattened nearly empty cells 50–400μ in diameter, bounded by one or two series of much smaller subglobose or flattened subcortical cells; cortex 1–3-stratose, the surface jelly firm and 13–28μ thick: antheridia beginning as shallow pockets in the cortex, soon becoming more or less confluent and covering a large part of the thallus surface, mostly, however, bounded by narrow reticulately disposed series of sterile cells. [PLATE 30; PLATE 33, FIGURES 1–5.]

La Paz, *Vives 20e* (type) and *11b*.

No. 20*e*, the larger of the two specimens seen, is antheridial and 11*b*, the smaller, is sterile. The plants are somewhat Rhodymenioid in habit, but their structure is rather more suggestive of that of plants of J. Agardh's subgenus *Podeum* of *Gracilaria*, though the medullary cells are more nearly empty than is customary in this group. However, the antheridia appear to harmonize much better with those of *Gracilaria*, so far as described, than with the wholly superficial or exserted and uninterruptedly expansive antheridia of *Rhodymenia*. So far as we are aware, the antheridia have been described in only three species of *Gracilaria*, viz., *G. confervoides*,* *G. armata*,† and *G. compressa*.‡

The antheridia of *Gracilaria confervoides* are described and figured as occupying nearly closed pear-shaped cavities, the bases of which penetrate the subcortical layer. Those of *G. Vivesii* are more like shallow saucers, often irregular in outline, and they are confined to the rather thin cortex and are covered only by the hyaline outer walls of what were originally epidermal cells; they seem to agree essentially with the descriptions of the antheridia in *G. armata* and *G. compressa*, and similar antheridia are present in a specimen from Barbados in the herbarium of the New York Botanical Garden, distributed as "*Gracilaria multipartita* J. Ag. fronde latiori" (Vickers, Alg. Barb. *136*).

The two nearest relatives of *Gracilaria Vivesii* are probably *G. Cunninghamii* Farl.§ (J. Ag. Sp. Alg. 3^4: 93. 1901), based upon material from Santa Barbara, California, and *Gracilaria* (?) *peruana* Picc. & Grun., from Paita, Peru. *Gracilaria Vivesii* differs from *G. Cunninghamii* in its brighter red (less brownish) color, in being regularly dichotomous instead of often somewhat tri- or polychotomous, in its less elongate, less cuneate, and broader

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* Thuret, in Le Jolis, Liste Alg. Mar. Cherbourg 134. 1863; Thuret & Bornet, Études Phyc. 80–82. *pl. 40. f. 1, 2.* 1878; Buffham, Jour. Quekett Micros. Club II. 5: 294. *pl. 13. f. 11, 12.* 1893.

† Thuret, Ann. Sci. Nat. IV. 3: 22. 1855; Thuret & Bornet, loc. cit.

‡ Thuret & Bornet, loc. cit.

§ This specific name appears to have originated through the misreading of a different genitive specific name accompanying a specimen sent to Agardh by Mrs. G. A. Hall.

(20–35 mm. max. *vs.* 10–13 mm.) segments, more patent or subdivaricate branching, and larger more vacuous medullary cells. *Gracilaria* (?) *peruana* Picc. & Grun. was briefly described and thus far appears to be known only from the original collection, from which, through the courtesy of Professor G. B. De-Toni, we have been able to examine a portion of a tetrasporic specimen. *Gracilaria Vivesii* differs from it in being of a coral-red or rose instead of a sordid green or lurid brownish color, in being regularly dichotomous instead of di-polychotomous, in having segments that are subquadrate or cuneate-oblong rather than subcuneate-linear and patent or subdivaricate rather than subparallel, and in having a cortex that is 1–3 instead of 3 or 4 cells thick in the mature parts and whose outer walls are 13–28μ instead of only 4–6μ thick. The medullary cells in *G. peruana* are large and vacuous, much as in *G. Vivesii*, but are even larger, sometimes showing a maximum diameter of 650μ in a cross section of the thallus. The transition from these large medullary cells to the small cells of the cortex is a little less abrupt than in *G. Vivesii*. The thallus of *G. peruana* is rather thicker than that of *G. Vivesii*, attaining a maximum thickness of about 1 mm. in the older parts of the fragment seen; it scarcely adheres to paper.

Rhodymenia peruviana J. Ag. is doubtless deserving of mention in connection with *Gracilaria Vivesii*. The writer's present knowledge of this Peruvian species is based chiefly on Agardh's description and a photograph of the original specimen which has been accessible through the kindness of Professor O. Nordstedt. Its mode of branching and general habit do not suggest the Baja California plant, and Agardh's allusion to sori in connection with the tetrasporangia would seem to indicate that *Rhodymenia peruviana* does not belong in *Gracilaria*. In size and in habit, so far as can be judged from a photograph, *Rhodymenia peruviana* is not very different from *Gracilaria* (?) *peruana*, yet Piccone and Grunow, having before them Agardh's description of the color and consistency of *R. peruviana* and having before them also the cystocarps and scattered tetrasporangia of their own Peruvian plant, were apparently quite right both in considering their plant different from Agardh's and in referring it to the genus *Gracilaria*.

Fauchea Sefferi sp. nov.

Thallus moderately thin (30–80μ) and cartilaginous-membranaceous when dry, cartilaginous and 135–320μ thick when moist, cespitose-ascending(?), dichotomous, mostly 6–11 times forked, spreading 7–12 cm., axils rounded or subacute, segments linear, 1–2.5 mm. wide, nearly uniform in width throughout or slightly wider under the dichotomies, rarely concrescent, margins entire (except for cystocarps), the terminal segments tapering, obtuse or subacute, somewhat divaricate or patent; color a dull brownish red; medullary layer of 2–6 irregular series of large elongate nearly empty cells, these often irregularly compressed and folded, 55–137μ × 22–55μ in cross section (or reaching 240 × 110μ in basal parts), with occasional small interstitial cells, passing rather abruptly to the subcortical layer of 1–3 series of smaller thick-walled cells; cortical layer composed of distinct anticlinal rows of 4–8 series of minute cells, these 3–9μ high, walls of cortical cells soft, gelatinous, and confluent: cystocarps marginal, sessile, nearly spherical, obovoid, or hemispherical, 0.5–0.95 mm. in diameter. [PLATE 31.]

La Paz, *Vives 11e.*

Fauchea Sefferi is in a way intermediate between the Mediterranean *F. repens* (Ag.) Mont. and the Californian and possibly northern *F. laciniata* J. Ag., but is amply distinct from both. From *Fauchea repens* it differs in the evidently non-repent habit of growth, in the thin and less cartilaginous thallus, in the narrower segments (1–2.5 mm. *vs.* 2–8 mm.), in the smaller, more gelatinous-walled, more irregularly compressed and often folded cells of the medulla, in the occurrence of occasional small interstitial cells among the large cells, and in the more globose sessile cystocarps. From *Fauchea laciniata*, *F. Sefferi* differs in the dichotomous instead of palmate-laciniate mode of branching, in having the principal segments narrower (often 1 cm. or more broad in *F. laciniata*) and linear rather than cuneate, in the smaller strictly marginal and non-coronate cystocarps, in the more gelatinous cell walls, the usually more compressed cells of the medulla, etc.

The specimens, dried under pressure, adhere fairly well to paper except in the older parts.

This species is dedicated to the memory of the late Dr. Pehr Olsson-Seffer, editor of the American Review of Tropical Agriculture and professor of botany in the new Mexican University, whose tragic and much lamented death in connection with the recent civil disturbances in Mexico occurred on April 29, 1911, a few days after he had communicated this and other Lower Californian algæ to the writer for determination.

Fauchea (?) **mollis** sp. nov.

Thallus thin (25–35μ) and membranaceous when dry, soft, lubricous, and 165–350μ thick when moist, cespitose-decumbent, flabellately subdi-trichotomous, the mats 6–9 cm. in diameter, the main segments mostly 5–8 times forked, radiating from a center and more or less overlapping in 2–4 layers, the layers here and there concrescent and coherent chiefly by deflexed more or less specialized originally marginal lobes, axils rounded and the segments again approximate or often overlapping; segments short-oblong, subquadrate, or occasionally subcuneate, 2–15 mm. broad, mostly as broad as long, margins entire, the terminal segments 2–5 mm. broad, rounded-truncate or bi-trifid-retuse; color a dull brownish red or greenish rose; medullary layer of 2 (3) series of large nearly empty cells, these mostly oval or elliptical and 82–275μ × 68–137μ in cross section, rounded-hexagonal or rounded-oblong when viewed through the cortex, without smaller interstitial cells, passing abruptly to the thin subcortical layer of 1–4 series of much smaller cells; cortical layer of mostly 2 series of minute cells 5–9μ high, anticlinal filaments scarcely recognizable unless at margins, walls of cortical cells soft, gelatinous, confluent, and hardly visible when soaked out, other parts wanting. [Plate 32; plate 33, figure 6.]

La Paz, *Vives 18a* (type) and *11f*.

The specimens described above are apparently sterile, but in habit and vegetative structure they have so much in common with *Fauchea* that we can feel little doubt as to their generic affinities. *Fauchea (?) mollis* is perhaps most nearly allied to the Australian *F. nitophylloides*,* but the segments of the Baja California plant are short-oblong or subquadrate instead of linear, the thallus is much thicker (165–250μ *vs.* 65–85μ) and much more gelatinous, so that it adheres very firmly to paper, the medullary cells are much larger (82–275μ *vs.* 27–68μ, long diameter in cross section) the walls of the cortical cells are gelatinous and confluent when soaked out instead of firm and distinct, and the color is a dull brownish red or greenish pink instead of scarlet.

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* For the privilege of examining authentic material of this species we are indebted to Professor W. G. Farlow and Mr. F. S. Collins.

J. Agardh has remarked that in habit *Fauchea nitophylloides* suggests *Rhodophyllis bifida* or narrow specimens of *Nitophyllum ocellatum*. It may be said that *F.* (?) *mollis* suggests the broader conditions of these species. In structure *F.* (?) *mollis* is not very different from certain species of *Gracilaria* of J. Agardh's subgenus *Podeum*, section *Rhodymenioideae*, but the cell walls and the frond as a whole are softer and more gelatinous than in any *Gracilaria* that we are familiar with and the large cells of the medulla are more hyaline and vacuous than is customary in that section of *Gracilaria*.

LAURENCIA PANICULATA (Ag.) J. Ag. Sp. Gen. et Ord. Alg. **2**: 755. 1852

Chondria obtusa paniculata Ag. Sp. Alg. 343. 1822.

La Paz, *Vives 22*.

Plants rather more slender and ultimate branchlets more elongate than in specimens from La Jolla, California, distributed in Phyc. Bor.-Am., *no. 1093*.

The current name for the species is used here provisionally, though the specific name appears to depend for its priority on its publication as a varietal name, which violates all of the current codes of nomenclature. Two older names in the specific category that are commonly cited as synomyms are *Laurencia patentiramea* (Mont.) Kütz. and *L. glandulifera* Kütz., but the older of these, *L. patentiramea*, according to Montagne's original figure, does not apply very accurately to our Baja California plant and there are possibly grounds for doubting the alleged synonymy. The elongate ultimate branchlets of the Vives plant are rather suggestive of those figured by Kützing (Tab. Phyc. **15**: *pl. 63. f. a, b.* 1863) for his *L. paniculata*, but they are not distichous or pinnate. Kützing's *Laurencia paniculata*, which, by the way, antedates J. Agardh's, is referred to *L. pinnatifida* by De-Toni; J. Agardh first cited it as a doubtful synonym under his own *L. paniculata*, but afterward (op. cit. **3**: 651) omitted to refer to it.

POLYSIPHONIA CALIFORNICA Harv. Ner. Bor.-Am. **2**: 48. 1853

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

The specimens are a little more luxuriant than Harvey's type from "Golden Gate, California," but they agree closely in habit, color, and structure.

The pericentral siphons are usually ten in number but vary from nine to eleven. The basal internodes are 6–10 times as long as wide. Simple colorless monosiphonous "leaves" are abundant at the tips.

CENTROCERAS CLAVULATUM (Ag.) Mont. in Durieu, Fl. Algérie **1**: 140. 1846

Ceramium clavulatum Ag. in Kunth, Syn. Pl. Aeq. **1**: 2. 1822.

La Paz, in the herbarium of the New York Botanical Garden, ex herb. C. L. Anderson, collector unknown.

The fragmentary specimen is from a stouter and more spiny plant than the original *Ceramium clavulatum* Ag., which was brought from Callao, Peru, by Humboldt. It also has shorter internodes and more forcipate apices. It suggests Kützing's figures of his *Centroceras oxyacanthum*, drawn from a South African specimen, though originally described from Cuban material; however, the spines are less conspicuous than in *C. oxyacanthum* and are not much in evidence, except at the apices.

The type of *C. clavulatum* in herb. Agardh is a slender plant with rather strict dichotomies, the tuft standing about 3.5 cm. high. The filaments are 85–110μ in diameter; the internodes are 320–510μ long below, becoming about 80–100μ long under the terminal dichotomy; the apices are incurved only in the youngest growth stages and are scarcely forcipate in the usual sense of the term; no lateral innovations were noticed; the spines are few, small, erect or incurved, and very inconspicuous, consisting of one or two cells and rarely reaching a length of 40μ. Kützing was doubtless right in suspecting* that the original *Ceramium clavulatum* belonged with his own *Centroceras cryptacanthum*, of which his var. β. *longiarticulatum* came from the coast of Peru, the type region of *Ceramium clavulatum* Ag.

Halymenia actinophysa sp. nov.

Thallus plane, sessile (?), very thin (70–130μ), gelatinous-membranous, elliptic-obovate or irregularly orbicular, attaining a length of 30 cm. or more and width of 20 cm., occasionally and irregularly perforate, the margins entire or sinuate or here and there irregularly dentate or lacerate, the surface nitent, the color mostly a light greenish rose; medullary filaments sparingly laterally or subdichotomously branched, 14–24μ in diameter, gradually enlarging distally (often becoming 27–40μ in older parts) and each terminated by a subglobose capituliform cell, this 45–95μ in diameter and emitting radially or stellately 3–14 (usually 6 or 7) rather straight and rigid branches, these connecting with one or two series of similar or more flattened radiately branched and reticulately joined subcortical cells, succeeded by one or two series of smaller subglobose or flattened anastomosing subcortical cells and the monostromatic or occasionally distromatic cortex; the cortical cells subglobose, obovoid, or more often flattened in the plane of the surface, 5–13μ in diameter, usually 3–6 from each subjacent cell: other parts unknown. [PLATE 34.]

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* Linnaea **15**: 742, 743. 1841.

La Paz, *Vives 20d.*

The three specimens on which the foregoing description is based are evidently fragments and some of the details of the diagnosis, especially as regards the size and form of the thallus, may require modification when more material is available. The specimens, also, appear to be sterile, but their structural characters are such that we feel little hesitation in referring them to the *Hymenopsis* section of *Halymenia*—the section that includes the European and Mediterranean *Halymenia latifolia* Crouan and *H. ulvoidea* Zanard., and possibly also the American *H. floridana* J. Ag. *Halymenia latifolia* has a firmer, relatively narrower, less nitent thallus of more definite regular form and a well-defined cuneate stipe; it is not certain that the holdfast is present in any of the Baja California fragments, but what appears to be a subtruncate or slightly cordate base in one of them suggests that the plant is sessile. *H. latifolia* has radially branched cells in the subcortex that sometimes resemble the smaller of the radiate or stellate subcortical cells of *H. actinophysa*, but they are (in a Brest specimen) only 25–30μ in diameter, have usually but 3–5 branches, and are nearly always much flattened; if these radiate cells in *H. latifolia* often in form suggest Asteroid or Ophiuroid "star-fishes," the corresponding cells in *H. actinophysa* in a detached condition may remind one of the pollen grains of certain Malvaceae or the "morning-star" maces of the 15th century.

The limits of *Halymenia floridana* J. Ag. are imperfectly understood and it is probable that the name has been applied to more than one thing, but, in any event, it has, as a rule, a considerably thicker, less gelatinous thallus than *H. actinophysa*, and is less nitent when dry. In a cystocarpic specimen from Florida in herb. Agardh, communicated by Mrs. Floretta C. Curtiss, the medullary filaments are 8–13μ in diameter and have dense granular contents, the subcortical layer consists of 1–3 series of ovoid or subglobose densely granular cells, mostly somewhat flattened in the plane of the thallus; conspicuously capitate endings for the medullary filaments are scarcely found, though the subcortical cells anastomose and are sometimes inconspicuously 3–6-radiate; it should be said, however, that there are frequent large ganglioid or irregularly stellate cells or filaments which have more homogeneous contents, and whose branches make their way freely among the ordinary vegetative filaments; these we take to be the sporogenous filaments. But in thicker, more gelatinous plants that have been referred to *H. floridana*, with more vacuous, more flexuous, and commonly a little larger medullary filaments (such, for example, as Phyc. Bor.-Am. *749a*, *b*, and *c*), one often finds stellate vegetative ganglia in the medulla and finds also the medullary filaments terminating in the subcortex in a subglobose radiately branched cell, but this rarely exceeds 30μ in diameter and its branches very rarely, if ever, exceed six in number.

Of *Halymenia ulvoidea* Zan. and *H. coccinea* Ardiss. we have been able to examine no authentic specimens, but *H. ulvoidea* is described and figured as having a dentate-ciliate margin and *H. coccinea*, which De-Toni hints may be *Callymenia Requienii*, is said to have a lamina only 1–2 cm. wide.

Halymenia actinophysa is in some respects rather suggestive of *Aeodes nitidissima* J. Ag., an apparently original cystocarpic specimen of which, collected by Berggren at Tauranga, New Zealand, and sent out by J. Agardh, we have been able to examine through the courtesy of Professor Farlow. But *H. actinophysa* is a thinner, softer, more gelatinous plant (the thallus of *Aeodes nitidissima* is about 240μ thick) and is quite different in vegetative structure. In *Aeodes nitidissima* the medullary filaments on reaching the subcortex send out usually 3 branches in a somewhat verticillate manner, but there is very rarely any tendency to a capitate enlarge-ment, in fact, the diameter of the filament commonly suffers a slight diminution at the nodal point; the cells of the subcortex have substellate anastomosing branches, but the cells are very small in comparison with the corresponding cells of *Halymenia actinophysa* and they rarely have more than 3 or 4 branches. The cortex of the New Zealand *Aeodes nitidissima* consists of distinctly anticlinal moniliform filaments of which the ultimate peripheral cells are, as described by Agardh, decidedly narrower than the subjacent cells ("exterioribus conspicue angustatis"); these cells are only 1–3μ in diameter when viewed from the surface, but in a cross section of the thallus are seen to be about twice as high as broad. It may be remarked that in the specimens from Whidbey Island, Washington, distributed in the Phycotheca Boreali-Americana (*no. 946*) as *Aeodes nitidissima* J. Ag., the cells of the cortex may hardly be described as being in distinct anticlinal rows, and the ultimate peripheral cells instead of being conspicuously narrower than those immediately subjacent are of equal width or even broader and have 2–4 times the diameter of the corresponding cells in the New Zealand plant.

The dried specimens of *Halymenia actinophysa* adhere very firmly and intimately to paper. The cell walls are so gelatinous and translucent that one gets little idea of the real structure of the thallus by examining an ordinary section in water or in water and glycerin—at least until one has learned otherwise what to expect and look for; but by staining sections or fragments with haematoxylin and afterwards swelling out the more or less collapsed cells by applying a little potassium hydrate or picric acid, the relations of the parts become manifest.

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Explanation of plates 27-34

PLATE 27. *Dictyota Vivesii*

A photograph of a portion of the type specimen (La Paz, *Vives 2*), natural size. The stipe is shown towards the lower right-hand corner.

PLATE 28. *Scinaia latifrons*

A photograph of a portion of the type specimen (La Paz, *Vives 11a*), nine tenths of the natural size. The cystocarps are visible near the margins in the median portions. See also FIGURE 1 (in text), which shows a better mounted, though mutilated specimen.

PLATE 29. *Anatheca dichotoma*

A photograph of a portion of the type specimen (La Paz, *Vives 7*), a little more than one third of the natural size.

PLATE 30. *Gracilaria Vivesii*

A photograph of a portion of the type specimen (La Paz, *Vives 20e*), about four fifths of the natural size.

PLATE 31. *Fauchea Sefferi*

A photograph of portions of the type specimen (La Paz, *Vives 11e*), natural size, showing marginal cystocarps, etc.

PLATE 32. *Fauchea* (?) *mollis*

A photograph of portions of the type specimen (La Paz, *Vives 18a*), natural size.

PLATE 33

1-5. *Gracilaria Vivesii*

1. A cross section of the thallus of an antheridial plant.

2. Surface of antheridial plant. The figure was drawn from a fragment soaked out in water and mounted in glycerin, in which medium the boundaries of the gelatinous walls of the vegetative cells cannot be seen with sufficient distinctness to be drawn accurately. In this mature condition of the antheridia, the gelatinous outer wall shown in FIG. 3 as covering the antheridium has mostly dissolved away and the spermatia occupy shallow cavities in the cortex.

3. A vertical section through an antheridium, which appears to arise through the transformation of the two outer layers of cortical cells.

4, 5. Young antheridia and adjacent vegetative cells in surface view.

FIGURE 1 is enlarged 57 diameters; 2–5, 345 diameters; all from the type specimen (*Vives 20e*).

6. *Fauchea* (?) *mollis*

A cross section through the thallus, enlarged 57 diameters.

7. *Cladophora MacDougalii*

An apical portion of one filament and a fragment near the apex of another, enlarged 11 diameters.

PLATE 34. *Halymenia actinophysa*

1. A cross section of the thallus, partially diagrammatic. The figure was drawn from dried material soaked out in water and mounted in glycerin, under which treatment the outlines of the various structural elements, particularly of the large cells of the subcortex, are less distinctly visible than indicated in the figure. The larger cells are often so flattened, collapsed, or translucent that the medulla commonly appears relatively broader and the cortex thinner than represented; and the medulla is often less compact.

2. A fragment from the cortex and subcortex, showing anastomoses of the subcortical cells, etc.

3. Another fragment, showing other forms of cortical cells and their relations to the subcortex.

4. Cortical cells in surface view; from a glycerin mount, in which the boundaries of the cell walls are too indistinct to be drawn with accuracy.

5. A similar view in an older part of the thallus, with the cell walls more swollen and the protoplasts more widely separated.

6. Cortical cells in surface view, after staining with haematoxylin and treatment with KOH. The grouping of the cells indicates more or less clearly their relations to the subcortical cells; e. g., the upper group of six cells crowns a single subcortical cell.

7. A stellate or radiate termination of one of the medullary filaments.

8, 9. Capitate and stellately branched terminations of the medullary filaments in more detail. The pedicel in each figure shows the beginning of a lateral branch.

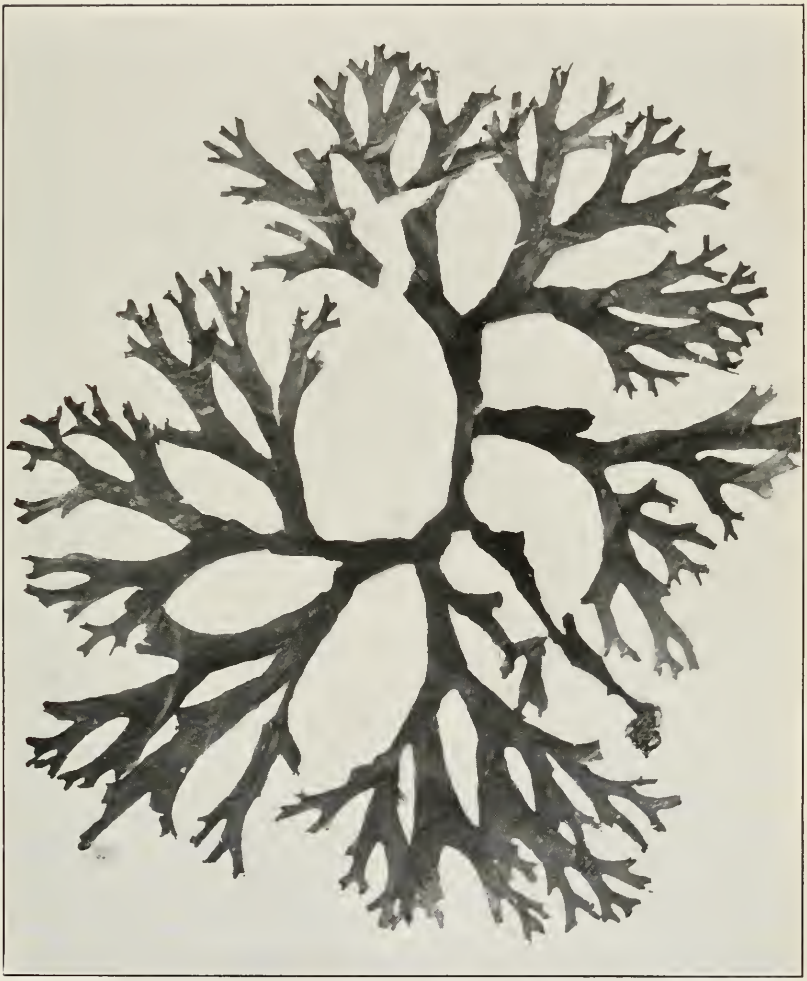
10. Cells of the subcortex, showing connections and mode of branching.

11. A somewhat flattened branched cell of a form that occurs in the subcortex about halfway between the cortex and the capitate terminations of the medullary filaments.

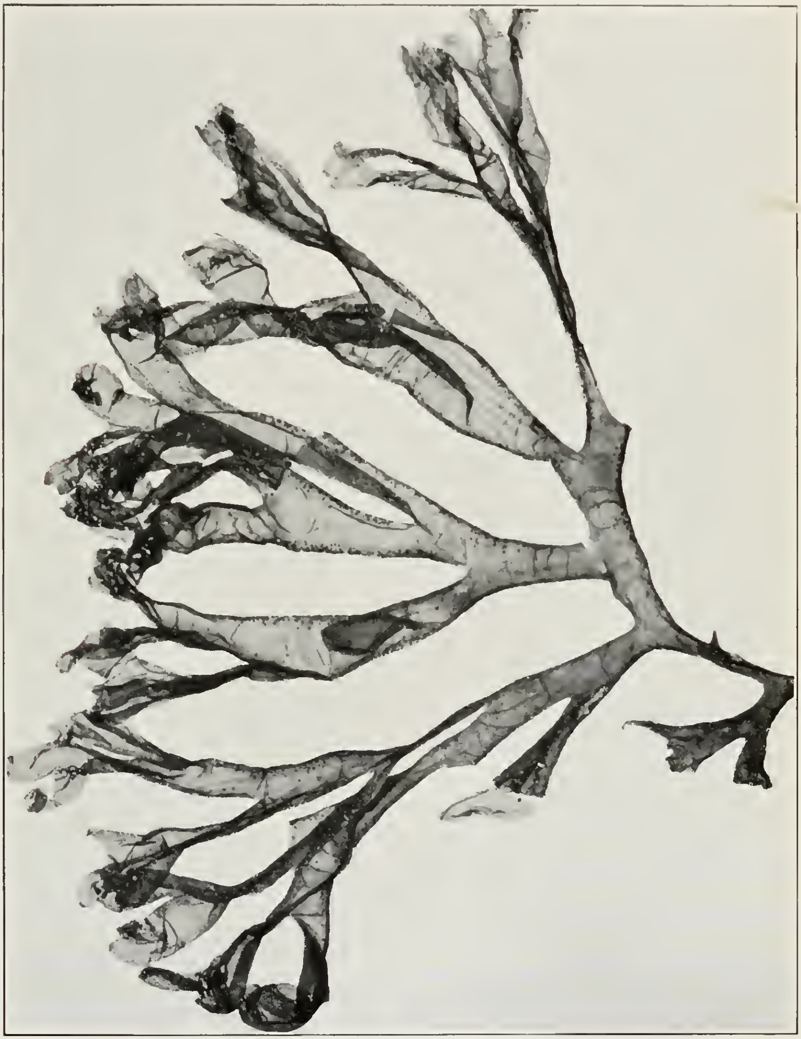
12. A portion of a medullary filament terminating in the subcortex and showing the beginnings of two lateral branches. The terminal cell of such branches carries a dense and conspicuous protoplast.

13. Stellately branched subcortical cells from a young part of the thallus, one of them showing 13 branches. These branches connect with other similar, but mostly smaller and more peripheral cells, from which they have been detached.

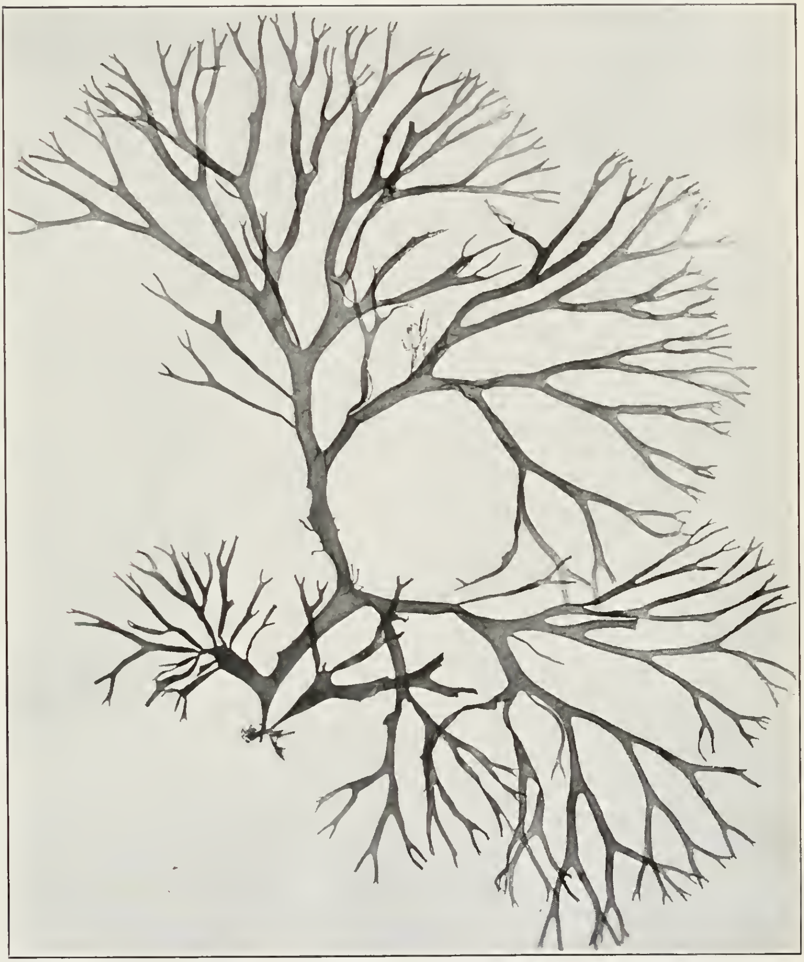
FIGURES 1–6, 8, 9, 11, and 12 are enlarged 276 diameters; 7 and 10, 46 diameters; 13, 244 diameters. The sections and fragments from which figures 2, 3, 6, 7–10, 12, and 13 were drawn were stained with haematoxylin and then swollen out with a solution of KOH; in figures 2, 3, 8, and 9, the thickness of the gelatinous cell walls and probably the dimensions of the parts in general have been somewhat exaggerated by an excess of KOH. FIGURE 11 was drawn from material that had been stained with picric-nigrosin.



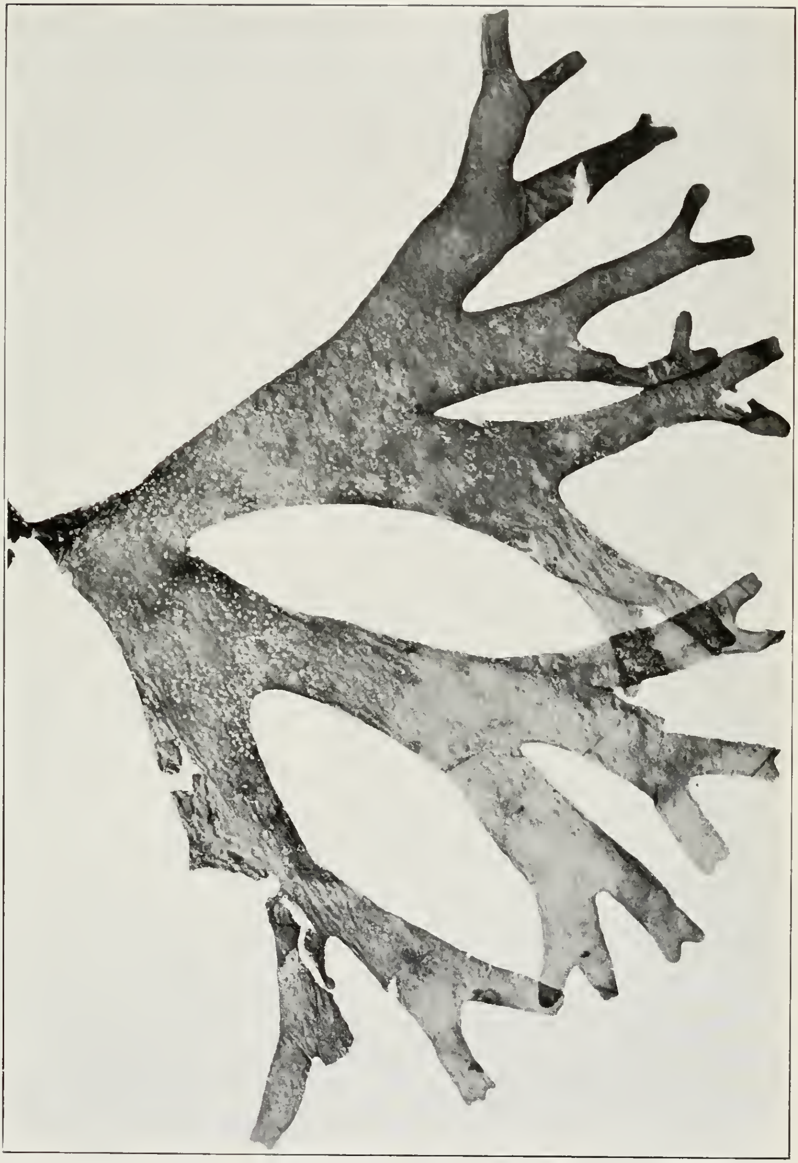
DICTYOTA VIVESII M. A. Howe



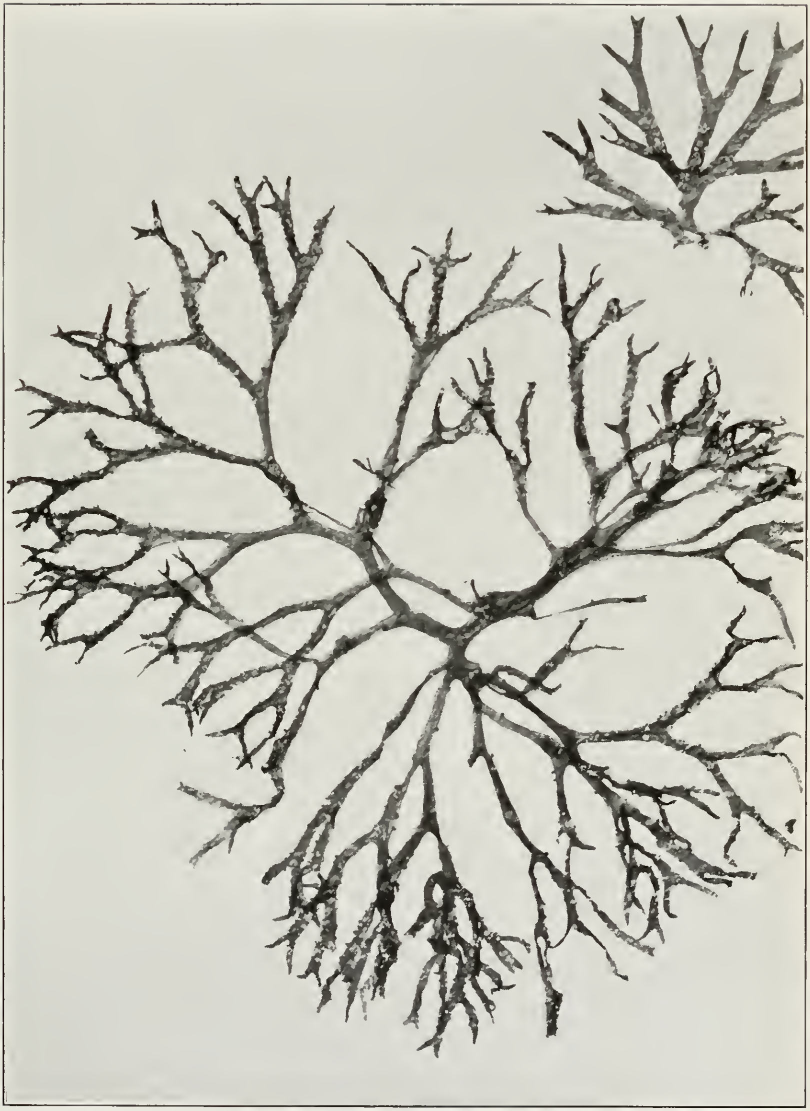
SCINAIA LATIFRONS M. A. HOWE



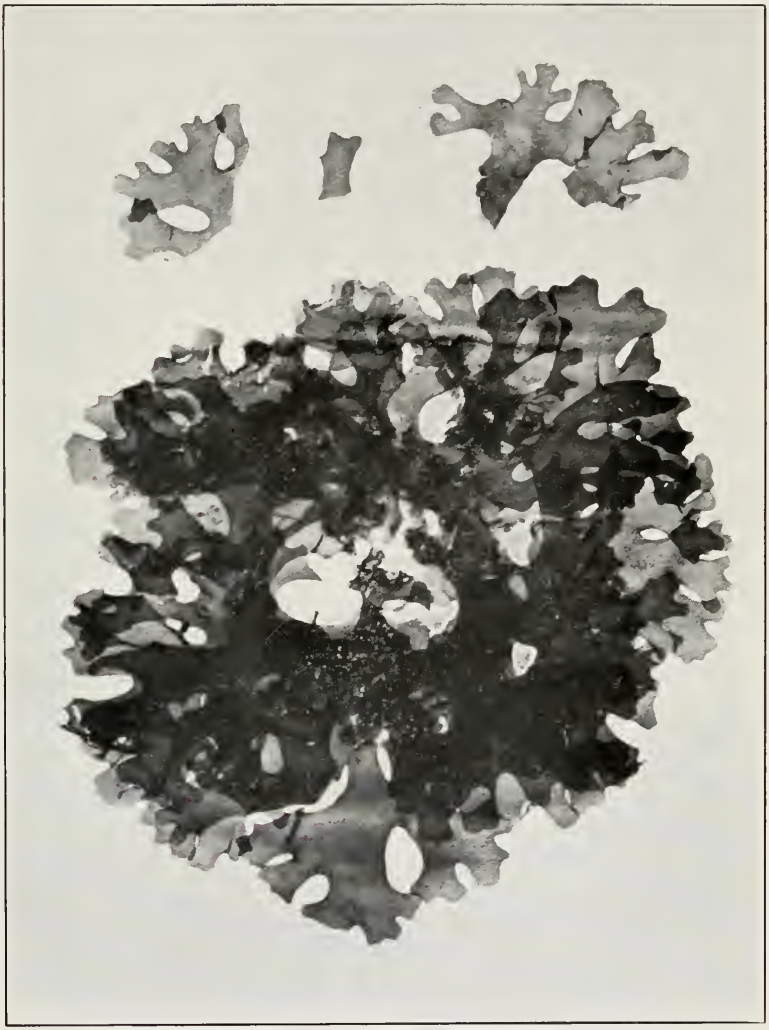
ANATHECA DICHOTOMA M. A. HOWE



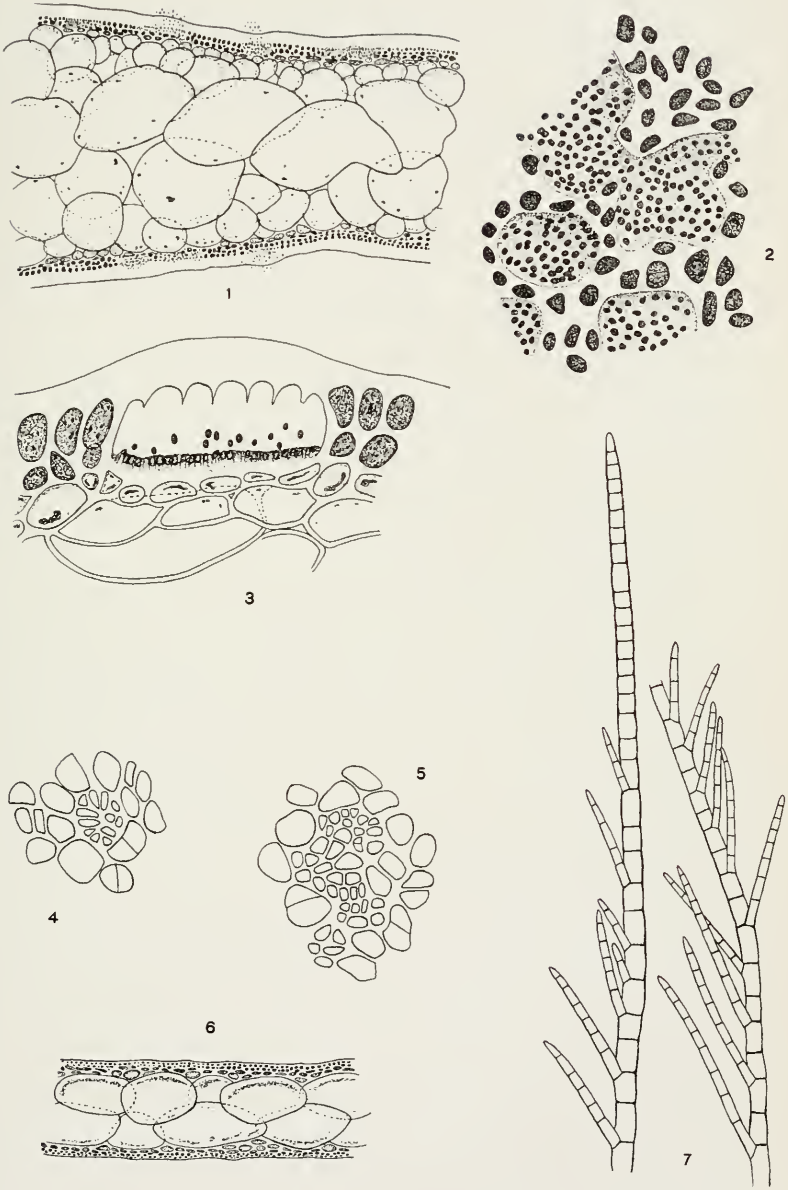
GRACILARIA VIVESII M. A. Howe



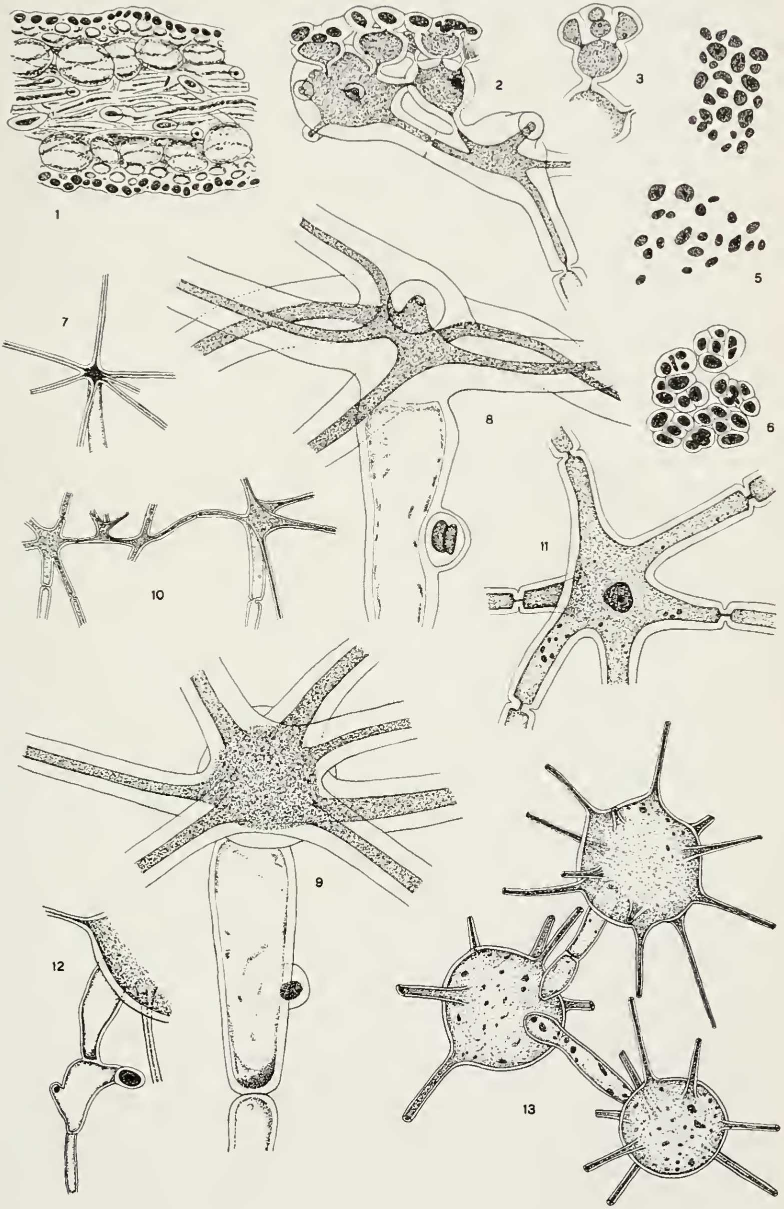
FAUCHEA SEFFERI M. A. Howe



FAUCHEA (?) MOLLIS M. A. HOWE



1–5. GRACILARIA VIVESII M. A. Howe
6. FAUCHEA (?) MOLLIS M. A. Howe
7. CLADOPHORA MACDOUGALII M. A. Howe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HALYMENIA ACTINOPHYSA M. A. Howe

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GARDEN—No. 147

STUDIES OF WEST INDIAN PLANTS—IV

BY NATHANIEL LORD BRITTON

NEW YORK
1912

Reprinted, without change of paging, from the BULLETIN OF THE TORREY BOTANICAL CLUB
39: 1-14. 10 F 1912

[From the BULLETIN OF THE TORREY BOTANICAL CLUB 39: 1–14. 12 F 1912.]

Studies of West Indian plants—IV

NATHANIEL LORD BRITTON

16. DENDROPANAX IN THE WEST INDIES

1. DENDROPANAX ARBOREUM (L.) Dcne. & Planch.

A tree, up to 20 m. high, but usually much smaller and often flowering as a shrub. Leaves chartaceous, from ovate to obovate, mostly acuminate at the apex, narrowed or rounded at the base, often 2 dm. long; inflorescence from shorter than the leaves to equaling them, or longer, the 20 umbels or fewer racemosely arranged and umbellate at the summit, sometimes leafy-bracted, but the bracts usually small, ovate to lanceolate; peduncles of the umbels slender, ascending, up to 3 cm. long in fruit; pedicels 1½ to 3 times as long as the flowers, somewhat elongating in fruit; petals white or greenish; calyx rather sharply toothed, about 2 mm. wide at flowering time; fruit black, strongly lobed, 6–8 mm. thick.

Widely distributed at lower and middle altitudes in moist or wet districts in Jamaica, Cuba, Hispaniola, Porto Rico, and on Signal Hill, St. Thomas. Ascends to 1,600 meters in Jamaica.

2. DENDROPANAX SAMYDIFOLIUM (C. Wright) Seem.

This species is known to me only from the original specimens collected by Wright at S. Felepina near La Grifa, western Cuba; Wright's description calls for a tree up to 13 meters high. The leaf base is decurrent on the petiole. The species seems very closely related to *D. arboreum*, which is abundant in the mountains and hills of western Cuba.

3. **Dendropanax brachypodum** (Urban) Britton nom. nov.

Gilibertia brachypoda Urban, Symb. Ant. 5: 452. 1908.

A short-petioled and long-pediceled Haitian mountain species, related to *D. arboreum*, known to me only from Professor Urban's description.

4. DENDROPANAX LAURIFOLIUM (E. March.) R. C. Schneider

A detailed description of this endemic Porto Rico mountain tree is published by Professor Urban in Symbolae Antillanae 1: 203.

5. DENDROPANAX CUNEIFOLIUM (C. Wright) Seem.

A shrub or tree up to 6 m. high, the branches slender, often drooping. Leaves spatulate to oblong-oblanceolate, 2 dm. long or less, 1.5–6 cm. wide, obtuse, or bluntly acute at the apex, cuneate at the base, the petiole 1/6 to 1/4 the length of the blade; peduncle slender, straight, as long as the leaves or longer; umbel 7–20-flowered; pedicels 1.5–2 cm. long; petals green, acute; flowering calyx about 4 mm. broad; fruit globose to globose-oblong, black, 6–8 mm. thick, the persistent style about half its length.

Banks of streams and wooded bogs at lower and middle elevations, Pinar del Rio and Isle of Pines, Cuba.

6. DENDROPANAX NUTANS (Sw.) Dcne. & Planch.

A shrub with stout gray branches. Leaves ovate to ovate-elliptic, coriaceous, 10 cm. long or less, acute or short-acuminate at the apex, narrowed or rounded at the base, the veins rather prominent on the under side, the stout petioles very unequal in length, sometimes two thirds as long as the blade; peduncle stout, 5–7 cm. long, bracted at or near the base; umbels many-flowered, inclined or nodding; pedicels 2–3 cm. long; flowering calyx 5 mm. broad.

Known only from Blue Mountain Peak, Jamaica, where it is reported as abundant. Professor Urban (Symb. Ant. 1: 200) characterizes the umbel as strictly erect, but it is inclined or nodding in all specimens seen by me.

7. DENDROPANAX PENDULUM (Sw.) Dcne. & Planch.

A shrub about 4 m. high. Leaves chartaceous in texture, ovate, acute or bluntish at the apex, rounded or subcordate at the base, triplinerved and rather prominently pinnately veined, the blades 12 cm. long or less, nearly twice as long as wide; petioles rather stout, one half to two thirds as long as the blades; peduncle much longer than the leaves, pendulous, 2 dm. long or less, bracted and jointed a little below the middle; umbel many-flowered; pedicels slender, 15–18 mm. long; flowering calyx broadly turbinate, 3.5 mm. broad; petals oblong-lanceolate, about as long as the calyx.

Cockpit Country, Jamaica, *Harris 9188*, from Lapland, near Catadupa; this specimen agrees with the type specimen of *Hedera nutans* Sw., in the herbarium of the British Museum of Natural History. The species is also recorded by Marchand from Catharine's Peak, collected by *Eggers, 3651*, which I have not seen.

8. **Dendropanax grandiflorum** sp. nov.

A tree, about 8 m. high. Leaves chartaceous, obovate, 5–10 cm. long, 5 cm. wide or less, bluntly pointed at the apex, cuneate-narrowed at the base, rather strongly pinnately veined, the margins slightly revolute, the stout petioles about 1 cm. long or less; inflorescence of simple, terminal, few-flowered umbels, or rarely a secondary umbel borne halfway up on the peduncle; peduncle rather stout, 3–5 cm. long, bracted and jointed just above the base; flowers 8 or fewer in the umbels; pedicels rather stout, nearly erect, 1.5–2 cm. long; flowering calyx 8 mm. high, narrowly campanulate, its mouth 6–7 mm. broad; corolla 5 mm. long just before expanding, the bud rounded; anthers in the unopen bud about as long as the filaments; fruit oblong, 1 cm. long, 7 mm. thick, the persistent style 6–7 mm. long.

Peckham woods, Upper Clarendon, Jamaica, July 7, 1911, *Harris 10994*.

9. **Dendropanax elongatum** sp. nov.

A slender tree about 8 m. high. Leaves clustered at the ends of the branches, oblong to oblong-lanceolate, coriaceous, faintly pinnately veined, acute at the apex, narrowed or somewhat rounded at the base, the blade 15 cm. long or less; the petiole one sixth to one third as long as the blade; peduncle shorter than the larger leaves, 8–12 cm. long, bracted somewhat below the middle, the bracts triangular-ovate, apparently nearly erect; very young inflorescence depressed-hemispheric, 8 mm. broad; the flower buds sessile or nearly so.

Peckham woods, Upper Clarendon, Jamaica, at 800 to 900 meters elevation, January 3, 1910, *Harris 10874*.

The very young state of the inflorescence does not enable me to give a description of the flowers of this interesting tree, and its generic position is therefore uncertain. Its jointed and bracted peduncle is similar to that of *Dendropanax pendulum*, but its foliage is altogether different from that species.

10. **Dendropanax grande** sp. nov.

A tree up to 16 m. high. Leaves clustered at the ends of the branches, ovate to ovate-elliptic, coriaceous in texture, rather prominently pinnately veined, obtuse at both ends, the blade 15 cm. long or less, the stout petioles as long as the blades, or shorter; peduncle much shorter than the leaves, erect, stout, about 4 cm. long, bracted at the base; pedicels numerous, about 50, rather stout, 2 cm. long; flowering calyx subhemispheric, 5 mm. broad; petals lanceolate, about as long as the calyx; filaments rather stout, somewhat longer than the petals.

Moneague, Jamaica, *Alexander Prior*, May 1850.

11. **Dendropanax blakeanum** sp. nov.

A slender tree about 8 m. high. Leaves clustered near the ends of the branches, elliptic, or somewhat obovate-elliptic, rather coriaceous in texture, faintly pinnately veined, sharply acute at the apex, cuneate at the base, 10 cm. long or less; the petiole one fifth to one third as long as the blade; peduncle erect, as long as the leaves or twice as long, bracted at the base; umbels 8–16-flowered; pedicels slender, 2 cm. long in fruit; flower buds ovoid-hemispheric, obtuse, 3 mm. long just before the petals unfold; calyx in young fruit turbinate, 4 mm. broad; fruit subglobose, 5 mm. in diameter; the conic persistent style 2.5 mm. long.

John Crow or Blake Mountains, Jamaica, at 550 meters elevation, *Harris & Britton 10761*, collected March 10, 1909.

Differs from *Dendropanax nutans* in the longer, strictly erect, few-flowered peduncles, and in the venation, texture, and shape of the leaves.

12. **Dendropanax cordifolium** sp. nov.

A tree about 6 m. high. Leaves clustered at the ends of the branches, chartaceous in texture, broadly ovate, prominently pinnately veined, obtuse, or short-acuminate at the apex, cordate, or subcordate at the base, the blades 2 dm. long or less, about two thirds as wide as long, the stout petioles about one half as long as the blades, or shorter; peduncle stout, bracted at and very near the base, inclined, longer than the petioles, 12–15 cm. long; umbels many-flowered; pedicels rather slender, 2.5 cm. long; flowering calyx broadly turbinate, 4–5 mm. broad; petals white, about as long as the calyx; filaments somewhat longer than the petals; persistent style of the young fruit very broadly conic, 2 mm. long or less.

Woodlands, summit of Dolphin Head, Jamaica, March 17, 1908, *Britton & Hollick 2856*.

17. THE GENUS CAMERARIA (PLUMIER) L.

The genus was accepted by Linnaeus from Plumier, *C. latifolia* being the type species, and *C. angustifolia* L. also appearing in the original publication of the genus, which is wholly West Indian in distribution, so far as I am aware.

1. Cameraria latifolia L. Sp. Pl. 210. 1753

This is a shrub or tree up to 15 m. high, as observed by me at the United States Naval Station, Guantanamo Bay, Cuba. It has characteristic ovate-elliptic acuminate leaves. Its fruit is about 6 cm. long. The species seems to be widely distributed in Cuba; occurring in the provinces of Oriente, Matanzas, and Havana. In Jamaica it is apparently rare, the only specimen seen by me being one collected by Dr. A. Hollick and myself (*2045*) in rocky woods at Negril, the extreme western end of that island. It is recorded from Haiti but I have seen no specimens from Hispaniola, which is presumably the type locality.

2. Cameraria angustifolia L. Sp. Pl. 210. 1753

My knowledge of this species rests wholly on Plumier's description and *plate 72*, *figure 2*, where it is illustrated as having linear-acuminate leaves and fruit 2.5 cm. long. According to Miller, cited by Grisebach, Fl. Br. W. I. 410, it was found in Jamaica, but it is unknown to us from that island.

3. Cameraria retusa Griseb. Fl. Br. W. I. 410. 1861

(C. *angustifolia* Griseb. loc. cit. not L.)

This is wholly a Cuban species, so far as it is represented in our collections, occurring in the provinces of Santa Clara, Havana, Pinar del Rio, and on the Isle of Pines. It has lanceolate to oblong leaves, which are obtuse and emarginate at the apex. Its fruit is about 2 cm. long, the narrowly linear terminal wing about as long as the ovoid body. Its flowers are only about 1 cm. long, the corolla limb about 1.5 cm. wide.

I take as the type of this species the specimen from "West Indies," collected by *Lane*, and preserved in the Kew Herbarium.

4. **Cameraria oblongifolia** sp. nov.

A tree 4–6 m. high with slender twigs. Leaves oblong to oblong-lanceolate, acutish to obtuse or minutely emarginate at the apex, narrowed at the base, 2–3.5 cm. long, 14 mm. wide or less, the slender petiole about 2 mm. long; corolla about 17 mm. broad; fruit compressed, lanceolate, 2–3 cm. long, about 1 cm. wide, grooved at the base on one side, the terminal wing oblong-triangular, obtuse, about as long as the body.

In wet woods near Tiffin, Camagüey, November 1–5, 1909, *Shafer 2877*; also represented by part of Wright's Cuban *no. 2950*, collected at Hanabana.

The other part of Wright's *2950*, which has ovate-lanceolate acuminate leaves, may represent another species. It has much more slender and longer petioles than *C. oblongifolia*, but the specimens examined by me are too imperfect to afford a complete description. Combs' *no. 19*, collected in Cieneguita in the province of Santa Clara, appears to be the same as this, but our specimen of that number also is incomplete.

5. **Cameraria microphylla** sp. nov.

A tree up to 5 m. high, intricately branched, the twigs very slender. Leaves oblong to oblong-obovate, 1 cm. long or less, 2–4 mm. wide, emarginate at the apex, narrowed at the base, the margins strongly revolute; fruit 2 cm. long, 4–6 mm. wide, compressed, the wing oblique, sinuate, terminal and lateral, similar to that of *C. latifolia* but very much smaller.

Near the northwestern end of Cayo Coco, Camagüey, October 23–24, 1909, *Shafer 2709*.

18. UNDESCRIBED SPECIES FROM JAMAICA

Acalypha jamaicensis sp. nov.

A shrub, 2–2.7 m. high, the branches slender, the young ones densely pubescent. Leaves oblong-lanceolate to oblong-oblanceolate, thin in texture, rather strongly pinnately veined, 9–15 cm. long, 3–5 cm. wide, sharply serrate all around, long-acuminate at the apex, subcordate at the base, sparingly pubescent above, rather densely pubescent on the veins beneath, the slender pubescent petioles 4 cm. long or less; flowers apparently monoecious; staminate spikes dense, pubescent, slender-stalked, about 3 cm. long, the short narrow bracts ciliate; pistillate spikes 3–6 cm. long, their bracts ciliate and pubescent, especially on the veins, 5–7-cleft to about the middle, the lobes obtuse or acutish; style dissected into filiform segments; fruit compressed, pubescent, 2 mm. broad.

Woodlands, Upper Clarendon, Jamaica. Type, *Harris 10842*, collected at Leicesterfield, January 28, 1910.

Related to *A. pruinosa* Urban, a nearly glabrous species with more deeply cleft pistillate bracts.

Actinostemon jamaicensis sp. nov.

A tree, up to 10 m. high, with slender, somewhat drooping branches, glabrous throughout. Leaves ovate to oblong-lanceolate, thin, 5–7 cm. long, 2–3.5 cm. wide, acuminate at the apex, rounded or narrowed at the base, shining above, pale beneath, pinnately veined, the very slender petioles 1 cm. long or less; staminate inflorescence interruptedly spicate, slender, 4–5 cm. long, flowers opposite the upper leaves; stamens 12, in clusters of 3, the united part and the free part of the filaments about equal in length; fruit depressed-globose, 9–12 mm. broad, 8–9 mm. high, both apex and base slightly sunken; seed globose, 3–3.5 mm. in diameter.

Thickets, Grant's Pen, near Yallah's Bay, Jamaica, May 26, 1911, *Harris 10936*, type; also at the same station, *Harris 10643*, *10818*, and *10826*, *Britton 3470* and *3913;* coastal thickets, Morant Point, *Britton 4103*.

Clusia clarendonensis sp. nov.

A small tree, up to 5 meters high. Leaves thick, rigid, obovate, 10 cm. long or less, 5–7 cm. wide, rounded at the apex, narrowed at the base, finely but rather strongly pinnately veined, the stout petioles 4–6 mm. long; fruiting peduncles stout, 3 cm. long; inflorescence about 3-flowered; fruiting pedicels about 1 cm. long; bracts triangular-ovate, acute, rigid, 5 mm. long; fruit oblong, obtuse, 2.5 cm. long, 1.5 cm. thick, the persistent sepals broadly triangular-ovate, scarious-margined; stigmas 5.

Peckham woods, Upper Clarendon, Jamaica, in fruit July 7, 1911, *Harris 10992.* Related to *C. venosa* Jacq.

Maytenus clarendonensis sp. nov.

A tree, up to 18 meters high. Leaves broadly elliptic, coriaceous, obtuse at both ends, 8–10 cm. long, 5–7 cm. wide, strongly revolute-margined, shining above, dull, and the veins rather prominent beneath, the stout petioles 1 cm. long or less; fruiting pedicels about 6 mm. long; capsules oblong, pointed at both ends, 15–18 mm. long, 8 mm. thick, roughened with depressed tubercles.

Peckham woods, Upper Clarendon, Jamaica, in fruit July 5, 1911, *Harris 10947.* Related to *M. jamaicensis* Krug & Urban.

Portlandia Harrisii sp. nov.

A small tree up to 6 meters high. Leaves orbicular, coriaceous, sessile, 8–10 cm. long and broad, rounded at the apex, cordate at the base, shining and reticulate-veined on both surfaces; stipules broad, obtuse; flowers 2–5 together in the upper axils, about 5 cm. long; corolla campanulate, the tube apparently about as long as the limb; fruiting pedicels stout, 6–8 mm. long; immature capsules obovoid, obtusely 5-angled, 2 cm. long, 1.5 cm. thick, crowned by the short calyx teeth.

On limestone rocks, Peckham woods, Upper Clarendon, July 6, 1911, *Harris 10975.* Only old withered fallen corollas were obtained.

Rondeletia saxicola sp. nov.

A shrub about 4 meters high, the twigs pilose-pubescent. Leaves thin, oblanceolate to oblong, acute at the apex, narrowed at the base, rather dark green and loosely appressed-pubescent above, paler green and loosely pilose-pubescent at least on the veins beneath, pinnately veined, 7–10 cm. long, 3 cm. wide or less, the pilose petioles about 1 cm. long; flowers in short-stalked globose clusters about 1 cm. in diameter, the rather stout, densely pubescent peduncles 5–8 mm. long; bracts linear, acute, 5–8 mm. long; calyx 4 mm. long, pubescent, lobed to below the middle, the lobes narrowly lanceolate, acute; fruit pubescent, about 5 mm. thick.

Rocky Cliff, Somerset, Manchester, September 23, 1908, *Harris & Britton 10609.*

Bidens clarendonensis sp. nov.

Perennial, glabrous, the stem and branches terete, trailing, somewhat woody. Leaves firm in texture, 4–7 cm. long,r hombic-ovate, acute at the apex, rather coarsely serrate, except at the broadly cuneate base, with slightly incurved gland-tipped teeth with revolute margins, the venation rather prominent, the petioles one fourth to one third as long as the blades; heads several together, on stalks 1.5 cm. long or less; involucre nearly hemispheric, many-flowered, its bracts about 1 cm. long, linear, obtuse or with a triangular acutish tip, 1.5–2 mm. wide; ray flowers about 5, 1.5–2 cm. long, the rays oblong, orange yellow, 2-toothed, 6–7 mm. wide, the tube about 3 mm. long; disk flowers 6 mm. long, the cylindric limb acutely 5-toothed; achenes 1 cm. long, less than 0.5 mm. thick, pappus of 1 or 2 subulate awns about 0.5 mm. long at flowering time, becoming 2 mm. long and downwardly barbed at maturity.

Peckham woods, Upper Clarendon, July 7, 1911, *Harris 10987.*

19. UNDESCRIBED SPECIES FROM CUBA

Mettenia acutifolia Britton & Wilson sp. nov.

A slender tree, 3–8 m. high, with hirsutulous twigs and petioles. Leaves ovate, occasionally lanceolate, 2–6 cm. long, 1–3.4 cm. broad, bluntly acuminate at the apex, rounded and equilateral or nearly so at the base, obscurely reticulate-veined and more or less pubescent with blackish hairs along the midrib and lateral veins above, hirsutulous on the midrib and lateral veins beneath, the margin ciliate; flowers unknown; valves of the capsule with crowded conic or subpyramidal tubercles, each tubercle tipped with a hair; seeds (immature) brownish black, lustrous, 4 mm. long, 3 mm. broad.

Camp La Gloria, south of Sierra Moa, Oriente, Cuba, December 30, 1910, *Shafer 8250.* Distinguished from *M. globosa* (Sw.) Griseb. by its spreading pubescence and by its pointed leaves.

Clerodendron (?) **calcicola** sp. nov.

A tree, 8 m. high, the branches smooth, the bark flaky in narrow strips. Leaves opposite, coriaceous, ovate to ovate-elliptic, distantly low-serrate, 10 cm. long or less, 3–5 cm. wide, glabrous, shining and with the inconspicuous venation somewhat impressed above, pale, strongly reticulate-veined with elevated venation, and rather densely pubescent beneath, the stout nearly terete petioles puberulent, 8–12 mm. long; flowers and fruit unknown.

Apparently related to *C. spinosum* Urban, of Santo Domingo, which has similar leaves with bristle-tipped teeth and villous petioles.

Pseudocarpidium pungens sp. nov.

A tree 8 m. high, the twigs slender. Leaves oblong to oblong-lanceolate, 3–7 cm. long, 3 cm. wide or less, chartaceous, strongly pinnately veined, spinulose-dentate, the apex acuminate, spinulose-tipped, the base obtuse, the upper surface smooth and shining, the under surface dull and puberulent; fruit irregularly 4-lobed, puberulent, depressed, 8 mm. in diameter.

Hillside, near Guantanamo, Oriente, Cuba, March 1909, *Britton 1992*, type; Sevilla Estate, near Santiago, Oriente, Cuba, *Norman Taylor 19*.

Related to *P. avicennioides* (A. Rich.) Millsp., which has entire leaves and more deeply lobed fruit.

Pseudocarpidium rigens (Griseb.) Britton comb. nov., *Vitex rigens* Griseb., has glabrous oblong to oblanceolate shining leaves, spinulose-dentate, at least above the middle, or some of them entire.

Portlandia nitens sp. nov.

A slender shrub, about 3 meters high. Leaves sessile, coriaceous, broadly ovate-elliptic, rounded at the apex, cordate or subcordate at the base, inconspicuously pinnately veined, shining above, dull beneath, 9 cm. long or less, the upper much smaller than the lower; flowers corymbose; pedicels short, viscid; calyx viscid, its lobes linear, about 8 mm. long; corolla pink, campanulate, 2.5 cm. long; capsule obovoid-oblong, 13 mm. long.

Dry thicket, upper valley of the Rio Navas, Oriente, March 22, 1910, *Shafer 4450*.

Elaeagia cubensis sp. nov.

A shrub, up to 3.2 meters high, the branches rather stout, the young twigs, branches of the inflorescence, and pedicels minutely pubescent. Leaves chartaceous, oblong or oblong-obovate, 7 cm. long or less, 2.5–3 cm. wide, abruptly short-acuminate at the apex, narrowed at the base, strongly pinnately veined, the petioles 6–9 mm. long; stipules narrow, obtuse, deciduous, 1 cm. long; panicles rather loosely flowered, 7 cm. long or less, minutely bracteolate; pedicels 2–3 mm. long; calyx tube obconic, 2 mm. long, the limb with 5 short rounded lobes; corolla white, 4 mm. long, its narrowly oblong lobes twice as long as the tube; filaments about as long as the corolla, the scale near the base of each with a dense tuft of white hairs; stigmas one fourth as long as the style.

Monte Jiquarito, Sierra Maestra, Oriente, Cuba, at about 1,100 meters altitude, September 18, 1906, *Norman Taylor 515*.

The genus has been hitherto known only from the South American Andes.

20. NOTES ON SPECIES OF SOLANUM

SOLANUM BLODGETTII Chapm.

This species is cited by Mr. O. E. Schulz* as a synonym of *Solanum bahamense subarmatum* (Willd.) O. E. Schulz, but he has wholly misunderstood its type specimens, which show that it is more nearly related to *S. verbascifolium* than to *S. bahamense;* it grows plentifully on Key West, Florida (*Blodgett*, type; *Merrill; Pollard, Collins & Morris 3; Britton 520; Lansing 1969*), in the Florida Everglades (*Britton 237; Small & Wilson 1678, 1962; Small & Carter 2674, 2675, 2936, 3101*), and is to be added to the West Indian Flora, as it occurs on Cat Cay, Bahamas (*Millspaugh 2341; Brace 3749*).

The varietal name *Solanum bahamense subarmatum*, under which Mr. Schulz groups nearly or quite unarmed specimens of *S. bahamense*, is redundant, for there is every transition from very prickly plants to entirely unarmed ones throughout the range of the species, individual bushes often bearing prickles below and being quite devoid of them above. *Harris 8169*, from Plowden Hill, Jamaica, as represented by our specimen, is unarmed, though the duplicate of it, examined by Mr. Schulz, is referred by him to the typical prickly form.

SOLANUM BOLDOENSE A. DC.

This interesting Cuban vine is apparently of quite local distribution at widely separated stations; about Matanzas it grows especially in the famous gorge of the Yumury or Yumuri River (*Rugel 145*). Mr. Schulz (loc. cit. 170) erroneously spells this "Tomory," while Mr. A. H. Moore* also has it wrong as "Sumuri." This gorge is one of the scenic attractions of the northern coast of Cuba; the handwriting of Rugel's labels is somewhat difficult to decipher. In Pinar del Rio it inhabits limestone rocks at San Diego de los Baños (*Britton, Earle & Gager 6674*); C. Wright's specimen *381* was collected in Oriente; the locality of the type specimen is doubtfully cited as Havana.

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* Urban, Symb. Ant. 6: 223.

21. NOTES ON TWO JAMAICA PLANTS

AMPELOCISSUS ALEXANDRI Urban, Symb. Ant. **6**: 15. 1909

To the description may be added "berry depressed-globose, black, shining, 1.5 cm. in diameter, the pulp watery; seeds 2 or 3, depressed-obovoid, slightly rugose, rather deeply and broadly grooved, 5 mm. long, 4 mm. wide."

Wooded hillside, Union Hill near Moneague, St. Ann's, Jamaica, at 500 meters altitude, *Britton & Hollick 2767;* this station is within a few miles of the type locality at Mount Diablo.

TABERNAEMONTANA DISCOLOR Sw. Prodr. 52. 1788

Tabernaemontana ochroleuca Urban, Symb. Ant. **6**: 34. 1909.

An examination of the type specimen of Swartz' species in the herbarium of the British Museum of Natural History establishes the identity of these species.

22. THE GENUS GINORIA IN CUBA

GINORIA AMERICANA Jacq.

As intimated by Koehne (Bot. Jahrb. 3: 349) this species may sometimes bear spines, as observed by me on plants in the palm barren at Santa Clara, in March, 1910 (*Britton & Wilson 6093*). This shrub grows along brooks and streams, attaining a height of 2.5 meters, at lower elevations in all provinces of Cuba, ascending to 160 meters in Oriente.

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* Proc. Am. Acad. 42: 530.

GINORIA SPINOSA Griseb. Cat. Pl. Cub. 106. 1866

I know this only from *Wright's 2545*, collected in eastern Cuba (not western Cuba, as cited by Koehne). Rugel's *727* from the Rio San Juan at Matanzas, as shown by our specimen, is certainly *G. americana* Jacq. and was so written up by Grisebach, though this number, as studied by Koehne, is by him referred to *G. spinosa*. The true *G. spinosa* Griseb. (*Wright 2545*) is quite a different plant, with much smaller leaves and acicular spines; it is possible, however, that the species are not distinct.

GINORIA GLABRA Griseb. Cat. Pl. Cub. 106. 1866

Known to me from Wright's *2544*, collected in eastern Cuba; and from Shafer's *8784*, collected at Farallon de la Perla, Oriente, where it grows on cliffs as a shrub 6 dm. high. It is evidently quite distinct from the other species.

Ginoria arborea sp. nov.

A tree, 8 meters high, the trunk up to 2.5 dm. thick, the bark gray, the branching irregular, the twigs of the season 4-angled with internodes 5–15 mm. apart; nodal spines 4, spreading, recurved, yellowish, 1–1.5 mm. long. Leaves sessile, linear-oblong, 1.5–3 cm. long, 2–5 mm. wide, coriaceous, bright green, shining, obtuse at the apex, narrowed at the base, strongly pinnately veined, the veins prominent on both surfaces; flowers solitary in the axils; pedicels filiform, a little shorter than the leaves; sepals triangular-lanceolate, acute, 4 mm. long.

Thicket, Leeward Point, United States Naval Station, Guantanamo Bay, Cuba, March 1909, *Britton 2217*.

GINORIA CURVISPINA Koehne, loc. cit. 349. 1882

In the palm barren near Santayana, Camagüey, this species is a shrub 1 meter high (*Britton 2368*); near Tiffin, Camagüey, it grows in wet woods and becomes nearly 3 meters high.

Ginoria ginorioides (Griseb.) Britton comb. nov.

Diplusodon ginorioides Griseb. Cat. Pl. Cub. 106. 1866.
Ginoria Diplusodon Koehne, Bot. Jahrb. 3: 350. 1882.

This beautiful shrub or tree inhabits cliffs and rocky hillsides; in the province of Santa Clara it ascends to 560 meters on the southern slope of the Trinidad Mountains, and at sea level on the southern coast becomes a tree up to 7 meters high; the flowers are rose pink to purple and densely cover leafless branches in March.

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LIST OF PLANTS COLLECTED ON THE PEARY ARCTIC EXPEDITION OF 1905-06 BY DR. L. J. WOLF, AND OF 1908-09 BY DR. J. W. GOODSELL

By P. A. RYDBERG

NEW YORK
1912

Reprinted, without change of paging, from the TORREYA 12: 1-11. 24 Ja 1912.

[[Reprinted from TORREYA, Vol. 12, No. 1, January, 1912.]

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BY P. A. RYDBERG

FERNS*

Dryopteris dilatata (Hoffm.) A. Gray (*Aspidium spinulosum dilatatum* Hook.). A rather common species of north temperate regions of America, Europe, and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 78*, *86*, and *88*.

Filix fragilis (L.) Underwood (*Cystopteris fragilis* Bernh.). A species distributed over most parts of the world in colder or mountainous regions.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 43*.

MONOCOTYLEDONS

Alopecurus alpinus Smith. A grass of arctic swamps and meadows of North America, Europe, and Asia, also found in the northern Rocky Mountains and the mountains of Scotland.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 23;* vicinity of Cape Sheridan, Grant Land, June 15–17, 1909, *Goodsell 56*.

Calamagrostis canadensis L. A common grass of open woods, thickets, and meadows from Labrador to North Carolina, California, and Alaska.

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* Determined by Mr. R. C. Benedict.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 64* and *66*.

Deschampsia flexuosa (L.) Trin. In dry places from southern Greenland to North Carolina, Tennessee, and Michigan; also in Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 65* and *62* (the latter bears leaves only, but probably belongs here).

Poa alpina L. An alpine-arctic grass, distributed over arctic and subarctic North America and extending south to Quebec and Lake Superior and in the Rocky Mountains to Colorado; also in Europe and Asia.

Grant Land, July, 1906, *Wolf*. Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 9*.

Poa glauca Vahl. (*P. caesia* Smith). An arctic grass of circumpolar distribution; found also in the White Mountains of New Hampshire and some of the mountains of northern Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 63* and *87*.

Poa glauca elatior And. With the species but less common and apparently restricted to arctic North America.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 24*.

Poa abbreviata R. Br. A very rare, truly arctic species, distributed from the arctic coast of North America to Greenland and Spitzbergen.

Grant Land, July, 1906, *Wolf;* vicinity of Cape Sheridan, Grant Land, June 15–July 17, 1909, *Goodsell 57;* also a sterile tuft (not numbered) which probably belongs here.

Poa evagans Simmons. The specimens in the collection are doubtfully referred to this species, of which there are no specimens in the herbaria here in America. The only locality given by Simmons is on the southern coast of Ellesmere Land.

Grant Land, July, 1906, *Wolf*.

Festuca rubra L. Meadows from Greenland to North Carolina, California, and Alaska; also in Europe and Asia.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 40.*

Festuca supina Schkur (*F. ovina supina* Hackel). A fairly common dry-land species of arctic-alpine North America, Europe, and Asia, in this country extending south to Vermont, Colorado, and California.

Vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 55.*

Festuca supina forma *vivipara.* The specimens in this collection have the glumes hirsutulous, at variance with the usual form of *F. supina.* They match perfectly specimens collected by Lundbom at Nunarsuak, Greenland.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 67* and *76.*

Eriophorum Scheuchzeri Hoppe. In swamps from Greenland to Newfoundland, Manitoba, Oregon, and Alaska; also in Europe.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 3;* ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 75.*

Carex canescens L.* Swamp from Newfoundland and Labrador to Virginia, Colorado, Oregon, and Alaska; also in Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, *Goodsell 69.*

Carex brunnescens gracilior Britton.* Moist places from Labrador to New York, Colorado, and British America.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 68.*

Juncoides hyperboreum (R. Br.) Sheld. (*Luzula confusa* Lindebl.). A species of arctic America, Europe, and Asia; extending south in this country to the mountains of New England and the northern Rockies.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 22.*

DICOTYLEDONS

Salix Waghornei Rydb. A rare willow, found in Newfoundland and Labrador.

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* Determined by Mr. K. K. Mackenzie.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 73*. (Leaves only, but evidently belonging here.)

Salix glauca L. A species common in arctic and subarctic Europe. The specimens belong to the American form growing in Labrador and Newfoundland. It differs considerably from the European form, especially in pubecsence, and may be distinct.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 72*.

Salix arctica Pall. A dwarf arctic species of willow, common in Asia and western North America but rare in the northeastern part of the latter continent. Only a small sterile specimen was collected by Dr. Wolf, which seems to belong to this species.

Grant Land, July, 1906, *Wolf*.

Salix groenlandica (Anders.) Lundstr. A dwarf arctic willow confined to Greenland, Labrador, and the islands of Baffin Bay.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 5;* Grant Land, Latitude 82° 27′, July, 1906, *Wolf*.

Salix anglorum Cham. (*S. arctica* R. Br.; not Pall.; *S. arctica Brownei* Anders.). A dwarf arctic species, ranging from Greenland to Alaska.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 6* (depauperate); vicinity of Cape Saumarey, August, 1908, *Goodsell 26*.

Oxyria digyna (L.) Hill. The arctic sorrel is common in arctic and alpine regions of North America, Europe, and Asia, extending south in this country to New Hampshire, Colorado, and California.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 19;* vicinity of Cape Sheridan, Grant Land, July 15 to Aug. 17, 1909, *Goodsell;* Grant Land, July, 1906, *Wolf*.

Bistorta vivipara (L.) S. F. Gray (*Polygonum viviparum* L.). In cold swamps from Greenland to New Hampshire, Colorado, and Alaska; also in Europe and Asia.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 20*.

Alsine Edwardsii (R. Br.) Rydb. (*Stellaria Edwardsii* R. Br.). An arctic species ranging from Greenland and Labrador to the Hudson Bay region, the Canadian Rockies, and Alaska.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 15;* vicinity of Etah, Aug. 8-16, 1908, *Goodsell 37;* Grant Land, July, 1906, *Wolf.* In *Goodsell 15*, the calyx is more or less white-villous.

Cerastium alpinum L. An arctic-alpine species, the range of which extends from Greenland to Quebec, the Canadian Rockies, and Alaska; also in Europe and Asia.

Grant Land, July, 1906, *Wolf;* vicinity of North Star Bay, Aug. 3-6, 1908, *Goodsell 8;* vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 13;* ravine on Caribou Island, Battle Harbor, Aug. 15, 1909, *Goodsell 79;* vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 54.* (The latter is a depauperate form answering to var. 3 of Simmon's Vascular Plants of Ellesmereland.)

Cerastium alpinum lanatum Lindebl. An arctic variety, confined to Greenland and neighboring islands.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 14.*

Wahlbergella apetala (L.) Fries (*Lychnis apetala* L.). An arctic-alpine species, distributed through the colder parts of Europe, Asia, and North America, in the latter extending south to Labrador and in the Rockies to Utah and Colorado.

Grant Land, July, 1906, *Wolf.*

Wahlbergella triflora (R. Br.) Fries (*Lynchnis triflora* R. Br.). An arctic species, apparently confined to Greenland.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 10;* vicinity of Etah, Aug. 6–18, 1908, *Goodsell 41* (poor and doubtful specimen).

Ranunculus nivalis L. An arctic-alpine species, distributed over parts of Europe, Asia, and North America, in the latter extending from Greenland and Labrador to the northern Rockies and Alaska.

Vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 51.*

Papaver radicatum Rottb. (*P. nudicaule* Lange, not L.; *P. alpinum* Am. auth.; not L.). The so-called "Iceland poppy" is one of the most showy arctic species and in many places is the characteristic plant of the arctic flora. It is common in the whole arctic region of North America and Europe, less so in Asia, where *P. nudicaule* L., a related species, is more common.

P. radicatum extends south to Labrador and in the Rockies to Colorado.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 1;* vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 12;* vicinity of Etah, Aug. 6–18, 1908, *Goodsell 36;* vicinity of Cape Sheridan, Grant Land, June 15–17, 1909, *Goodsell 50;* Grant Land, July, 1906, *Wolf.*

Draba alpina L. A circumpolar arctic species, in America extending south to Labrador and the Canadian Rockies.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 2;* vicinity of Cape Sheridan, Grant Land, June 15–17, 1909, *Goodsell 53* (depauperate).

Draba glacialis Adams. An arctic-alpine species distributed over most of the northern part of Asia and North America, in the latter extending south in the Rockies to Wyoming.

Vicinity of Cape Sheridan, June 15–July 17, 1909, *Goodsell 52.*

A specimen with rather densely pubescent pods is doubtfully referred here. The typical *D. glacialis* has the pod glabrous or nearly so.

Grant Land, July, 1906, *Wolf.*

Draba fladnizensis Wulfen. An arctic-alpine plant, distributed through the arctic and subarctic regions and the higher mountains of Europe, Asia, and North America, extending as far south as the Pyrenees, Himalayas and the Rockies of Colorado.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 18;* vicinity of Etah, Aug. 6–18, 1908, *Goodsell 46.*

Draba hirta L. A circumpolar arctic species, also found in the mountains of Europe and Asia, but in America confined to the arctic regions.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 25.*

Braya glabella Richardson. A rare species confined to arctic America.

Grant Land, July, 1906, *Wolf.*

Cochlearia groenlandica L. A strictly arctic species, probably of circumpolar distribution.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 27.*

Cochlearia fenestrata R. Br. An arctic species, closely related to the last and often confused with it. It is apparently confined to arctic America.

Grant Land, July, 1906, *Wolf.*

Rhodiola rosea L. (*Sedum Rhodiola* DC.). A species not uncommon in the arctic and mountainous parts of Europe; in America confined to the north, extending south to Newfoundland and Maine in the east. It has also been collected at two stations in Pennsylvania.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 74.*

Saxifraga cernua L. A circumpolar arctic-alpine species, in America extending south to Labrador and in the Rocky Mountains to Colorado.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 16;* vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 60* (depauperate specimen); Grant Land, July, 1906, *Wolf.*

Saxifraga rivularis L. A circumboreal species, in America extending south to the White Mountains and to the Rocky Mountains in Montana.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 48.*

Muscaria caespitosa (L.) Haw. (*Saxifraga caespitosa* L.). A circumpolar arctic and subarctic species, extending in America from Greenland to Labrador, Montana, British Columbia, and Alaska.

Vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 59.*

Leptacea tricuspidata (Rottb.) Haw. (*Saxifraga tricuspidata* Rottb.). An arctic-alpine species, ranging from Greenland to Labrador, Lake Superior, the Canadian Rockies, and Alaska.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 47* and *42;* vicinity of Cape Saumarey, Aug. 8, 1909, *Goodsell 28.*

Leptacea flagellaris (Willd.) Small (*Saxifraga flagellaris* Willd.). A circumboreal alpine-arctic species, extending in America south in the Rockies to Arizona.

Vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 58;* Grant Land, July, 1906, *Wolf.*

Antiphylla oppositifolia (L.) Fourr. (*Saxifraga oppositifolia* L.). A circumpolar arctic-alpine species, in America extending south to Vermont, Montana and British Columbia.

Vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 49;* vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 11;* Grant Land, July, 1906, *Wolf.*

Potentilla emarginata Pursh. An arctic species, ranging from Greenland and Labrador to the Canadian Rockies and Alaska; also in Siberia and on Spitzbergen.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 7;* vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 32.*

Potentilla Sommerfeltii Lehm. A rare arctic species, growing in Spitzbergen, Greenland, the Baffin Bay islands, and the arctic coast of America.

Grant Land, July, 1906, *Wolf.*

Potentilla pulchella R. Br. An arctic species of the same range as the preceding, but it has also been collected on Wrangel Island off Siberia.

Vicinity of Etah, Aug. 6–18, 1908; *Goodsell 39.*

Potentilla Vahliana Lehm. An arctic species, ranging from Greenland through the islands north of Hudson Bay, and the arctic coast of America to Alaska.

Vicinity of Cape Saumarey, Aug. 8, 1909, *Goodsell 31.*

Sibbaldiopsis tridentata (Soland.) Rydb. (*Potentilla tridentata* Soland.). A plant of rocky places, ranging from Greenland to the mountains of Georgia, west to Minnesota and Manitoba.

Ravine on Caribou Island, Battle Harbor, Aug. 15, 1909, *Goodsell 82.*

Comarum palustre L. A swamp plant distributed through northern and subalpine Europe, Asia, and America, ranging in the latter from Greenland to New England, Minnesota, Wyoming, California. and Alaska.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 77.*

Rubus Chamaemorus L. An arctic and subarctic bog plant, ranging from Labrador and Newfoundland to New Hampshire, British Columbia, and Alaska; also in Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 91*. (The specimens are in leaf only.)

Dryas integrifolia Vahl. An arctic and subarctic species, distributed from Greenland to Anticosti and Alaska.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 4*. Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 21*.

Empetrum nigrum L. An arctic and subarctic undershrub of wet and rocky places from Greenland to Maine, northern New York, Michigan, Montana, and Alaska; also in Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 70*.

Viola palustris L. In swamps from Labrador to New England, Colorado, Washington, and Alaska; also in Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 83*.

Chamaenerion latifolium (L.) Sweet (*Epilobium latifolium* L.). An arctic-alpine plant of moist places, ranging from Greenland to Quebec, Colorado, Oregon, and Alaska; also in Europe and Asia.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 33*.

Epilobium palustre L. A circumpolar bog plant, extending in this country south to the White Mountains and Ontario.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 84*.

Cornella suecica (L.) Rydb. (*Cornus suecica* L.). A circumpolar arctic or subarctic plant of wet woods, ranging in this country from Labrador and Newfoundland to Quebec and Alaska.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 85*.

Conioselinum pumilum Rose sp. nov.

Stems simple or nearly so, low, 12 to 15 cm. high, glabrous, purplish, somewhat fluted; stem leaves 2 or 3, small, 3 to 6 cm. long, ternately divided, ultimate segment sharply toothed or cleft, glabrous; inflorescence a small compact terminal umbel, sometimes with an additional lateral one; involucre none; involucel bractlets several, filiform, longer than the pedicels; rays 12 to 18 mm. long, only slightly if at all scabrous; pedicels 3 to

4 mm. long, glabrous; fruit smooth; carpels 3 to 3.5 mm. long, a little longer than broad; stylopodium depressed.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 81*.

Pyrola grandiflora Radius (*P. rotundifolia grandiflora* DC.). An arctic and subarctic bog plant, ranging from Greenland to Labrador and the Mackenzie River.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 45*.

Cassiope tetragona (L.) D. Don. An arctic species, distributed from Greenland and Labrador to Washington and Alaska; also in Asia.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 30*.

Ledum groenlandicum Oeder (*L. latifolium* Ait.). A bog plant, ranging from Greenland to Massachusetts, New Jersey, Wisconsin, British Columbia, and Alaska.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 71*.

Vaccinium Vitis-idaea L. A circumpolar undershrub, common in Europe but rare in America, there ranging from Greenland to Massachusetts, Lake Superior, British Columbia, and Alaska.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 90*.

Campanula uniflora L. An arctic-alpine species, ranging from Greenland and Labrador to Alaska and in the Rockies south to Colorado; also in northern Europe and Asia.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 17*.

Solidago macrophylla Pursh (*Solidago thyrsoidea* E. Meyer). A plant of rocky woods from Labrador to the Catskill Mountains, Lake Superior, and Hudson Bay.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 80*.

Erigeron trifidus Hook. An arctic-alpine species, distributed from Greenland to Colorado, California, and Alaska.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 38*.

Arnica alpina (L.) Olin. An arctic and subarctic species, ranging from Greenland to Labrador, the Canadian Rockies, and Alaska.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 34* and *44*.

Taraxacum phymatocarpum Vahl. An arctic species, confined to Greenland and Ellesmere Land.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 29;* vicinity of Etah, Aug. 6–18, 1908, *Goodsell 35*.

Taraxacum pumilum Dahlst. An arctic species, confined to the arctic American archipelago.

Grant Land, July, 1906, *L. J. Wolf*.

Taraxacum hyparcticum Dahlst. An arctic species, ranging from northwestern Greenland through the arctic archipelago, along the arctic coast to Point Barrow, Alaska.

Grant Land, July, 1906, *L. J. Wolf*.

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CONTRIBUTIONS FROM THE NEWYORK BOTANICAL
GARDEN — No. 149

STUDIES IN PYROPHILOUS FUNGI—III. THE VIABILITY OF THE SPORES OF PYRONEMA

By FRED J. SEAVER

NEW YORK
1912

Reprinted, without change of paging, from Bulletin of the Torrey Botanical Club 39: 63-67. *pl. 4.* 9 Mr 1912.

[From the Bulletin of the Torrey Botanical Club, 39: 63-67, *pl. 4.* 9 Mr 1912.]

Studies in pyrophilous fungi—III.* The vitality of the spores of Pyronema

Fred J. Seaver

(with plate 4)

In the first paper of the present series, in attempting to impress upon botanists the value of *Pyronema* as a plant to be used in regular class study, it was stated that no data were at hand as to the length of time during which the spores of this fungus would keep their viability. As a knowledge of this point is of vital importance in determining whether the teacher is able to tide over this plant in the laboratory from year to year, it is deemed worthy of special study and mention at this time.

As has been previously stated, when once this fungus has been cultivated it is comparatively easy to "get a catch" from the air by simply exposing properly heated soil and keeping it moist for a few days. Especially is this true in greenhouses. To my knowledge, since this fungus has been under observation here, steamed or heated soil used for planting in the propagating houses of the New York Botanical Garden has never failed to develop the fungus. Some time ago the spores of the fungus were sent to Purdue University for experimental purposes, and recently in a conversation with Dr. F. D. Kern he informed me that this fungus also now made its appearance in their greenhouse whenever heated soil was exposed. While the fungus may usually be obtained in this way when once it is started, this method is uncertain and the occurrence of the plant is likely to be delayed when it is most needed. It is therefore better to develop and rely upon some more certain methods of securing and preserving it.

During the present winter the fungus was desired for study in classes at Columbia University, and several pots of heated soil were exposed to the air, as formerly, in the laboratories of the

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* Studies in pyrophilous fungi—II. Changes brought about by the heating of soils and their relation to the growth of *Pyronema* and other fungi, was published in Mycologia 2: 109–124. *pl. 24–26.* 1910.

New York Botanical Garden. As it had been some time since the fungus had been under cultivation at the Garden, the spores were apparently not very numerous in the air, for after several days the plant failed to appear. Search was then made for some recently collected spores for inoculation. No attempt had been made to keep the spores for this purpose and the youngest specimens available in the herbarium of the Garden had been collected nearly three years before. The soil was inoculated with these aged spores, and within a few days a good growth of *Pyronema* was produced, the infection apparently proceeding from the point of inoculation. As this experiment did not prove with certainty that the old spores germinated, it was decided to test them out in hanging drop culture.

A complete history of the specimen used in the above experiment is as follows. In the spring of 1909, a pile of leaves and brush was burned, and this opportunity was taken to test the growth of *Pyronema* under natural conditions, as the fungus was at that time under cultivation in the laboratory. Spores were taken from the plants grown in the laboratory and with these the burned place was inoculated. In a reasonably short time our burned place showed a good growth of the fungus. One good specimen was collected and placed in the herbarium of the Garden in an ordinary paper packet. In January 1912 the spores from this specimen were used for the experiment described above, and while many of the spores failed to germinate, there was enough growth in a hanging drop culture to form a web of mycelium over the cover glass on which the spores were planted.

The spores of *Pyronema* are rather thin-walled and are not the kind of spores, so far as general appearance is concerned, that would be expected to keep their viability for a long period of time. Also, it would naturally be thought that spores which are adapted to withstand long periods of unfavorable conditions as resting spores would not germinate readily when fresh. The spores of this fungus are an exception in both of these particulars, for the fresh spores germinate very readily in hanging drop culture and very old spores germinate with equal facility; also, the walls of the spores do not appear to be thicker than the walls of the young mycelium and show no protective structures.

The spores germinate by putting out a germ tube from each end, one end, however, growing much faster than the other. The young mycelium is very coarse, the diameters of the main branches being fairly constant. The whole mycelium is filled with vacuoles, giving it a characteristic appearance. The spore before germinating swells much, becoming large and very granular. The germ tube as it issues from the spore is slightly smaller in diameter than the spore but often swells to about the same diameter. The contents of the spore after germination are similar in appearance to the contents of the young mycelium, and there appears to be no difference between the wall of the old spore and that of the young mycelium, the spore forming one segment in the growing mycelium, usually of a little larger diameter and shorter but often so nearly like the other segments of the mycelium that it is difficult to determine the position of the old spore. In some cases the spore seems to swell up and begin to grow by simply cutting off new segments at either end.

The spores of *Pyronema*, as shown in the present experiment, will keep their viability for nearly three years; as to how much longer they will remain good we cannot at present say. Griffiths* in his work on Fimetariaceae (Sordariaceae) found one species in which the spores kept their viability for more than three and one-half years.

The demonstration of the long viability of the spores of *Pyronema* is one more argument in favor of the introduction of this fungus into college and university courses in botany which deal with a general knowledge of the subject. The cultivation of the fungus requires no complicated technique, and the rapidity with which the plant grows would enable the student to study all of the stages from the germinating spore to the production of sex organs and mature ascocarps within a period of about ten days. Also, the asci of *Pyronema* when mounted in water illustrate very nicely the common method of spore dissemination among the ascomycetes.

Claussen† in his recent paper on the development of *Pyronema* states: "Es wirt angegeben dass *Pyronema* auf Brandstellen häufig vorkomme. Häufig kann aber wohl der Pilz nicht sein, da ich ihn bisher nur ein einziges Mal—bei Eberswalde—im Freien fand. So oft ich sonst sowohl bei Freiburg wie bei Berlin solche Stellen absuchte, hatte ich keinen Erfolg."

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* Griffiths, D. The North American Sordariaceae. Mem. Torrey Club **11**: 1–134. *pl. 1–19.* 30 My 1901.

† Claussen, P. Zur Entwicklungsgeschichte der Ascomyceten, *Pyronema confluens.* Zeit. Bot. **4**: 1–80. *pl. 1–6.* 1902.

While nothing can be said here as to the occurrence of the fungus in Europe, the fact remains that it is fairly common in America so far as our knowledge goes. Of course its occurrence in nature depends upon the presence of recently burned areas accompanied by a reasonable amount of precipitation. Given these conditions, and the fungus is common. It has been collected by the writer in Indiana, Iowa, New York, and North Dakota and has been frequently reported by collectors from other states.

If it should happen that the fungus is not common in a given locality, or as is more likely to be the case, has never been recognized, it has been shown in previous papers that the fungus is easily cultivated in the laboratory; and now having proved the long viability of the spores which enables the plant to be carried over for an indefinite length of time in the laboratory, there is no longer any reason for considering *Pyronema* an uncommon fungus. If the fungus is worth knowing from a morphological point of view it is also worth seeing.

DIRECTIONS FOR CULTIVATION AND PRESERVATION OF THE SPORES

Heat good rich, unfertilized, garden soil by placing it in pots or other receptacle. The heating can be accomplished by steam or dry heat in an autoclave or sterilizing oven. If dry heat is used run the temperature up to 150°–170° C. If neither autoclave nor sterilizing oven is available, bake in an ordinary oven for an hour or more at ordinary baking temperature. Cool and water with tap water. Plant the spores and place the pot under a bell jar. Growth of mycelium should be abundant in two or three days at room temperature; sex organs should appear in about a week and mature ascocarps a few days later.

When through with the study of plants, scrape off the old ascocarps together with a little dirt, place them in an envelope and keep dry until they are desired for study the next year, then prepare substratum and plant as before.

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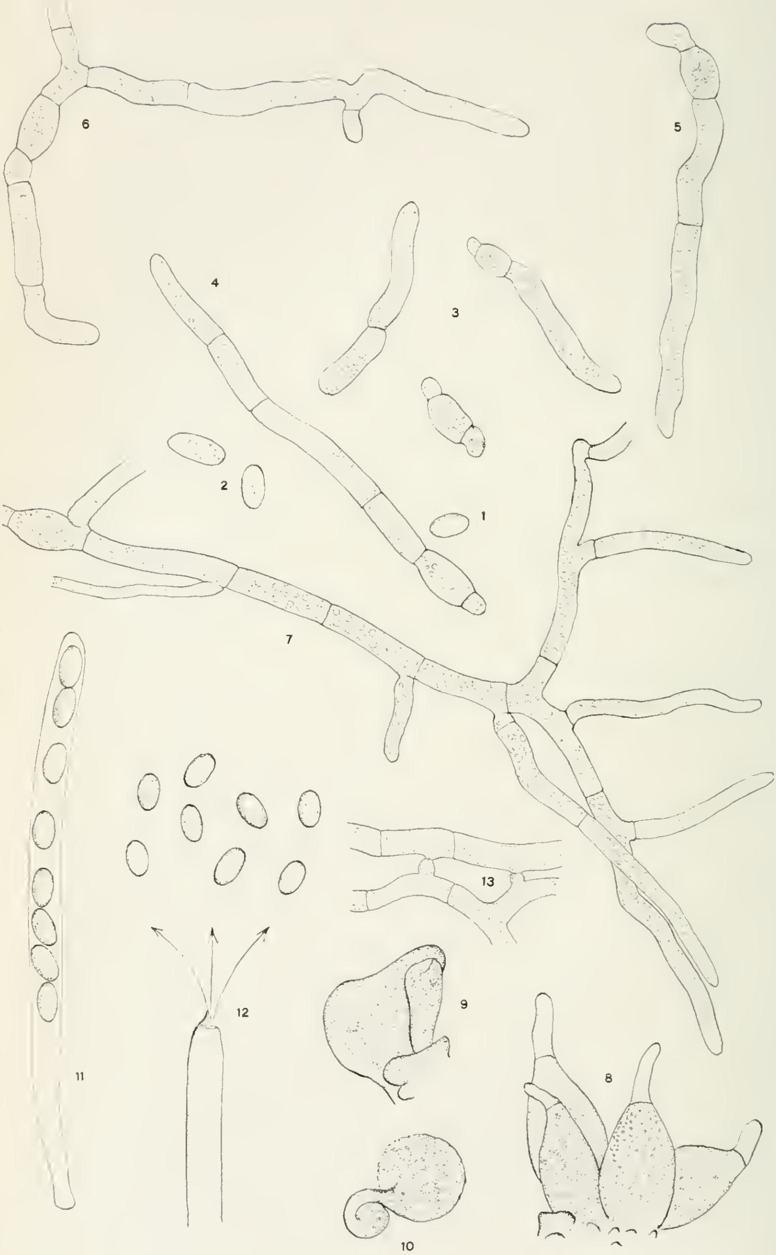
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SEAVER, ON PYRONEMA

Explanation of plate 4

Pyronema omphalodes

1. Normal ungerminated spore.
2. Spores slightly swollen and apparently about to germinate.
3–7. Stages in the germination of spores on the third morning after planting.
8. Young ascogonia.
9–10. Ascogonia and antheridia, side and end view.
11. Mature ascus.
12. Ascus showing dissemination of spores.
13. Anastomosing mycelium.

All figures are drawn with the camera lucida; 1–7 and 13 show stages in the developing spores collected in the spring of 1909 and germinated January 1912, as they appeared on the third morning after planting.

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GARDEN—No. 150

THE INDIVIDUALITY OF THE CHROMOSOMES AND THEIR SERIAL ARRANGEMENT IN CAREX AQUATILIS

By ARLOW BURDETTE STOUT

NEW YORK
1912

Reprinted, without change of paging, from the ARCHIV FÜR ZELLFORSCHUNG
9: 114–140. *pl. 11, 12.* 3 D 1912.

The individuality of the chromosomes and their serial arrangement in Carex aquatilis.

By

Arlow Burdette Stout.

With plates XI and XII.

Much evidence has accumulated in recent years in support of the doctrine of the individuality of the chromosomes. Their permanence, division, and growth are now well established facts. Observations are also recorded as to the relations of these individual units both in the general organization of the nucleus and in regard to the possible pairing of the maternal and paternal chromosomes in the somatic nuclei. Such investigations are of special significance for the problems of heredity. The studies here reported concerning the nuclear phenomena in *Carex aquatilis* relate especially to the identity of the individual chromosomes in all stages of nuclear development and to the fixed relative place arrangement of these individual units.

JUEL (1900) describes and figures the principal stages of pollen formation for *Carex acuta* and his work is all that we have on the cytology of the genus *Carex*. His figures show stages from synapsis to the development of the generative cell and prove conclusively that three of the microspore nuclei degenerate, thus confirming and extending the work of ELFVING (1879) and STRASBURGER (1884) on *Heleocharis*. JUEL does not determine the method of chromosome reduction in the heterotypic division. The chromosomes do not even appear visibly paired in his figures of diakinesis. Still the general appearance of his figures for *Carex acuta* is strikingly similar to that of the same stages as I find them in *Carex aquatilis*.

My material was collected in the vicinity of Madison, Wisconsin, where *Carex aquatilis* is abundant. Tips from the large soil roots were fixed at various dates during the growing season. Flower spikes were collected three or four times a week from the time the first leaves appeared until the pollen was shed. Both root tips and male and female flower spikes were fixed in the Flemming chrom-osmium-acetic solutions. The strong, medium, and weak strengths were all used. The best results were obtained with the strong for the root tips and the medium for the anthers. To secure good penetration of the flower spikes they were first dipped in Carnoy's fluid, or split lengthwise, or the glume-like bracts subtending the staminate flowers were removed. Flower spikes were also fixed in picro-formol solution with rather good results. The imbedded material was cut in sections from four to eight μ thick. For staining, the Flemming triple combination was used almost exclusively, although a few slides of each of the best series were stained with iron-haematoxylin. It was found that better staining results were secured when Merck's "perhydrol" diluted in 70% alcohol to a strength of 3% was used as a bleach instead of commercial "dioxogen".

Description of observations.

The Resting Nuclei.

The resting nuclei in the embryonic region of the root tips are rather large in proportion to the size of the cells. One, two, or three nucleoles may be present as conspicuous spherical bodies. The chromatin appears in these resting nuclei in the form of small but definite oval masses, the "pseudo-nucleolen" of Zacharias (1895) and Rosenberg (1904), "chromocentren" of Rosenberg (1909b) or the "prochromosomes" of Overton (1905). These masses are distributed rather evenly about the periphery of the nucleus. Aside from these chromatin masses with the connecting strands of linin and the nucleoles, the entire nuclear cavity appears to be filled with a homogeneous achromatic substance. The nucleoles may lie near the center or to one side of the nucleus. The chromatin masses are distributed rather evenly about the periphery of the nucleus. In well stained preparations it is also evident that these masses are connected together in longer or shorter series and do not form a reticulum such as has been commonly described for the resting nuclei. The serial arrangement is not always easily recognized at this stage, but by careful study it can always be observed, at least in certain parts of a nucleus. It is difficult to represent this arrangement in drawings. In my figures the chromatin masses lying in the higher focal planes are drawn darker, but the windings of the series cannot be brought out fully.

Plerome, periblem and dermatogen, and calyptrogen are sharply delimited in the roots of *Carex aquatilis* and the lines of demarcation are even carried through the embryonic apex of the root. The resting nuclei of all these regions show the structure described above. I have drawn a group of cells from the center of the embryonic region to show this (fig. 4). Cells *a* and *b* belong to the plerome, *c* and *d* to the periblem and dermatogen, and *e* is a cell of the calyptrogen. These are typical resting cells of the embryonic region.

That the chromatin masses which are present in these nuclei are the individual chromosomes is evident from a study of their subsequent history and appearance in the division figures. In shape they are somewhat irregular but compact masses entirely similar to the chromosomes as they appear in the middle prophases of the somatic divisions. In careful counts in a large number of resting nuclei I have in no case found more of these masses than the number of diploid chromosomes. The number established by counts of the equatorial plates of somatic, heterotypic, and homoeotypic division figures is, as near as I can determine, seventy-four. The chromatin units in the resting nuclei are small and often two or three of them are more or less massed together or overlie each other so that it is not possible to count them with complete certainly. It is clear, however, that their number does not exceed that of the chromosomes appearing in the equatorial plate.

The preparation shown in figure 4 is characteristic in this particular. The entire nucleus of cell *c* is present in the section and in it nearly seventy individual chromatin bodies are visible. Parts of the other nuclei drawn did not show in the section. Of the nuclei *b* and *e* about one-half is shown and forty-two chromatin units appear. Larger portions of the nuclei *a* and *d* are shown with a proportionally greater number of chromatin masses.

As noted above, a most conspicuous and interesting feature of the resting nuclei is the arrangement of the chromatin masses in series. It is not entirely clear that there is a single continuous spirem at this stage, but as is clearly shown in the drawing, in various regions of a nucleus a series can be traced for some distance. Where two series cross or are massed together it is difficult to trace the line. Cross fibres from one series to another may be present, but they are secondary. In these resting nuclei the chromosomes are definite bead-shaped bodies connected by rather thin strands of linin. When closely placed the series is easily traced; where the individuals are farther apart the connecting linin strands are followed with more difficulty.

The Somatic Division.

In entering the prophases, a nucleus enlarges slightly and the chromosomes increase in size. They retain, however, the same shape they had in the resting nuclei. While increasing in size they separate somewhat from each other and become quite evenly distributed against the nuclear membrane somewhat as the bivalent chromosomes are placed in diakinesis. They are also somewhat angular or even drawn out at different points as if connected with each other by cross fibres from various directions (figs. 5*b* and 6).

The chromosomes are at this stage almost isodiametric and their shape does not itself suggest the trend of the series, still in many of the nuclei in this stage of division the series can be followed at various places for some distance. The connecting strands of linin are thin and are not sharply differentiated from the chromatin by the stain.

Judging from the frequent occurrence of this stage in sections of root tips and young anthers, it must persist for some time. It may be characterized as the growth stage, and in it the chromosomes make their greatest visible increase in size. The resting nuclei range in diameter from 4,5 to 6,75 μ with the chromosomes about 0,2 or 0,3 μ in diameter. In the prophase stage just described the nuclei are from 6,75 to 7,5 μ in diameter and the chromosomes are from 0,3 to 0,4 μ in diameter. During later stages of the prophases the nuclei enlarge but little. The chromosomes, however, appear to enlarge somewhat. The relative sizes at various stages will be seen by comparison of figures 4, 5*b*, 10, and 11.

In passing from this stage the chromosomes move in from the periphery of the nucleus and their apparent arrangement in a single continuous spirem becomes more clear. The spirem is variously twisted and coiled about in the nuclear cavity. That it shows no breaks at all can not, of course, be established. There may be several rather long and more or less independent series. Figures 7*a*, 10, and 11 show several stages in the appearance of the spirem during the early prophases.

It is, however, clear in these nuclei of *Carex* that the chromosomes in resting stages and very early prophases do not primarily form a reticulum, but are connected in a series corresponding to the arrangement in the spirem as seen in the mid-prophase. The question as to the relation of the chromosomes from the paternal and maternal parents in the last previous fertilization is, of course, involved here and will be taken up in connection with studies of the fertilization processes which I shall report later.

In the spirem of the prophases the chromosomes are ellipsoidal or spherical masses. Although held rather closely together in a series, the outlines of each are clearly defined. There is no time when the substance of each is drawn out or when the chromosomes are merged together to make a dense homogeneous chromatic spirem. Such a spirem as is here described and figured I shall call a discrete spirem. By this term is here meant a serial alignment in which the individual chromosomes are clearly defined. At its most conspicuous stage this discrete spirem appears as in figure 11. It is least in evidence in the stage shown in figure 6.

During the prophases the one or more nucleoles are still intact and it is very clear that they do not break up into chromosomes or contribute directly any chromatin substance for the growth of the chromosomes. The discrete spirem draws in toward the nucleole and may become closely aggregated about it as is shown in figures 8 and 9. The chromosomes may thus become closely massed together, but their individuality and their serial arrangement is maintained, as is evident from a study of such a preparation as is represented in figure 9. Nuclei in this stage are not so numerous as are those in the earlier or the later stages, but the evidence is conclusive that this perinucleolar and centrally aggregated condition of the spirem regularly follows the withdrawal of the spirem from the periphery of the nucleus and precedes the equatorial plate.

Early in the prophases the characteristic polar caps appear at opposite sides of the nucleus in the position of the future poles of the spindle. On the periphery of these as is shown in figures 5*b* and 6 there is a felt of fibres for the most part arranged concentrically. Later the colorless area between this felt of fibres and the nuclear membrane is less sharply defined and the fibres extend through it to the membrane. The fibres are now more parallel and tend to lie in the axis of the future spindle. Some of them appear to be in contact with the nuclear membrane. The membrane breaks down first in such regions of contact and in doing so appears to pass over into a fibrous material as is well shown in figures 8 and 11. LAWSON's (1911b) conception that the nucleus is a vacuole whose membrane during the prophases shrinks until it envelops the chromosomes finds no support from the phenomena in *Carex aquatilis*.

The fibres of the cap continue to grow inward first through the cap and then into the nuclear cavity. The successive stages of their development are shown in figures 6, 10, and 11. When the fibres first grow into the nuclear cavity the spirem is somewhat looped or folded, the loops extending in the direction of the long axis of the spindle (fig. 12).

As the fibres continue to push into the nuclear cavity the loops of the spirem become flattened out in the plane of the equatorial plate. A lateral view of this stage is shown in figure 13. This stage is a very frequent one in my preparations. Figure 14 is a polar view of the series as it enters the equatorial plate and it shows that the serial order of arrangement of the chromosomes is still preserved. At this stage the spirem is irregularly looped and its parts may be crossed. Later as the chromosomes come to lie in the plane of the equatorial plate, the entire spirem lies in one plane without any apparent crossing of its parts. When the equatorial plate is completely formed the chromosomes are rather closely crowded together into an almost solid plate in which they are so evenly spaced that the serial arrangement is not clearly in evidence. At this time the nucleole is usually absent, but in some cases it can be seen at one side of the plate, but much reduced in size (fig. 13). During the late prophases the nucleole gradually decreases in size as if it were being dissolved.

It is to be noted that no split or line indicating the location of the future plane of cleavage is to be seen in the chromosomes at any time in the prophases. The mother chromosomes lie in the equatorial plate as compact ellipsoidal masses forming a rather solid plate. The whole number of mother chromosomes divides in the equatorial plate almost simultaneously. In a lateral view of an early anaphase two rather even ranks of daughter chromosomes are to be seen close together in the condition shown in figure 15. The daughter chromosomes are ellipsoidal or spherical in shape and when first formed they are about half the size of a mother chromosome.

A polar view of the group of daughter chromosomes during early anaphase shows that the serial arrangement is probably still maintained although the chromosomes are too close together to allow one to trace with absolute certainty a continuous series for any considerable distance. We may consider that in effect the discrete spirem that existed in the equatorial plate has been split into two daughter spirems, and that the chromosomes divide uniformly and simultaneously without losing their serial order. The daughter chromosomes thus maintain the same serial position with reference to each other which was occupied by the mother chromosomes. As the poles are reached the daughter chromosomes are usually closely packed together. Especially is this the case when a well developed system of polar rays extends from the polar ends of the spindle (fig. 16). In such cases the individual chromosomes are densely packed together. When there are few astral rays the chromosomes are more loosely aggregated and the individuals can often be distinguished. There is considerable variation in the degree of development attained by the spindle fibres and polar rays. Figure 16 shows a well developed figure with rather unusually heavy astral rays; figure 17 is a somewhat later stage of a more weakly developed spindle figure.

The nuclear membrane now forms about the whole group of daughter chromosomes while they are massed together. The daughter nucleus so formed enlarges and the mass loosens up somewhat, the chromosomes become separated, and it is seen that they lie against the membrane and are connected in series as shown in figures 18 and 5*a*. For a time various chromosomes remain massed together as is seen in figure 18.

One or more nucleoles appear simultaneously with the formation of the membrane. The nucleus continues to increase in size, the chromosomes become more widely distributed until the condition of the resting nucleus is again reached. Meanwhile the cell-plate forms from the central spindle fibres after which the fibrous system disappears and the cytoplasm passes into a finely reticulated and vacuolated condition.

Following the telophases there seems to be but little growth in the volume of the individual chromosomes. As one observes the resting nuclei he is impressed with the apparently small amount of chromatin compared with that present in the division stages. This is partly due to the scattered position of the chromosomes because of which only a part of them appear in a single optical section. They are, however, much smaller during the resting stages. Their visible increase in size is a preparation for division.

The characteristic features of the cell division in the root tips of *Carex* may be summarized as follows:

1. The chromosomes are individualized bodies which can be identified not only at every stage in the division, but in resting nuclei as well.

2. They also maintain a serial arrangement which gives them a definite position relative to each other. This arrangement in a discrete spirem is in evidence in resting nuclei, but is most conspicuous in the prophases.

3. The chromosomes also pass into the equatorial plate in the same serial order they had in the prophases and this order is probably maintained through the anaphases.

The nuclei in the cortex and in the central cylinder further back in the root where division has ceased also show the chromosomes as definitely individualized bodies. Figure 1 shows this feature in typical nuclei in elongated cells of the central cylinder.

In the nuclei of cells situated in the outer layers of the root cap and in still older portions of the root the chromosomes cannot be identified. In the dying cells of the root cap the nuclei decrease in size, the nucleoles become smaller and the nuclear cavity becomes filled with a dense granular substance which stains quite uniformly.

The Sporogenous Tissues.

Everywhere in the cells of ovary walls, styles, stigmas, filaments, tapetum, and sporogenous tissue the chromosomes are recognizable in the resting nuclei. They are especially conspicuous in the tapetal nuclei as shown in figure 3, in the nuclei of the filaments (fig. 7*b*), and in the nuclei of cells in the walls of the ovary (fig. 2). These nuclei are as a rule smaller than those of the root tips and accurate counts of such large numbers of chromosomes is not possible, but it is clear that the number of chromatic units does not exceed the chromosome number and that there is never a completely reticulated condition of the chromatin.

The resting nuclei in the archesporial cells of the young stamens range from 4,0 μ to 5,25 μ in diameter and are hence slightly smaller than the root tip nuclei. In the prophases of division, however, the nuclei often increase in diameter to 8,0 μ or 8,25 μ which is slightly greater than the diameter of the nuclei in the root tip during the same stage.

A cross section through a loculus at the stage of the early divisions of the archesporial cells shows that there it consists of a single outer layer of cells forming the wall, two rows of tapetal cells, and a single circle of wedge-shaped sporogenous cells. In such a section four or five sporogenous cells are usually shown. They are closely crowded together and are wedge-shaped in cross section with the apices in the center. The diameter of the entire cylinder of spore producing tissue at this stage is about 17 to 20 μ.

The Heterotypic Division.

When the spore mother-cells are fully formed and are passing into synapsis, five or six appear in a cross section of a loculus and the diameter of the whole cylinder of cells is from 22 to 25 μ. In the resting nuclei of the spore mother-cells the chromosomes are situated at the periphery and appear as shown in figure 19. In the presynaptic stages the nucleus enlarges to about 6,5 or 7,5 μ in diameter. The chromosomes draw away from the nuclear membrane appearing as in figure 20. They are now fusiform, which is due apparently to a sort of spinning out of their substance along the line of the spirem. At this stage it is seen that the spirem remains attached by fibrils to the nuclear membrane at certain points as at *a*, and *b*, of figure 20 as if it were viscous and adhered to it. The chromosomes may appear even to be attached together in various directions by fibrils as shown in figure 20. The serial arrangement is, however, readily traced at many points at least for short distances. The connections between the chromosomes in the line of the spirem become more and more conspicuous. The chromosomes evidently become elongated until they form a thin continuous chromatic thread, the leptoneme of WINIWARTER (1901). This spirem is much tangled, folded on itself or crumpled. The attachments to the nuclear membrane noted above persist for some time producing such appearances as are shown in figure 21. This figure resembles superficially that produced by second synapsis as described by Miss SARGANT (1896 and 1897), ALLEN (1905), and others, except for the thinness of the spirem. There is some indication of a parallel arrangement of the threads in this stage. This stage is the first figured by JUEL (1900), but there can be no doubt that it is a presynaptic stage. The attachments of the chromatic thread to the nuclear membrane are not permanent. They break away and when the synaptic knot is fully formed the entire chromatin thread is drawn together into a rather compact mass. It may be possible that delicate linin fibres still connect the mass with the nuclear membrane, but I have not been able to bring them out by staining.

The diameter of the nuclei in the presynaptic stages varies from 8,5 μ to ocasionally 10,0 μ. There has been a growth slightly in excess of that exhibited by the nuclei in the prophases of previous divisions.

The synaptic knot usually lies to one side of the nuclear cavity and it may or may not envelop the nucleoles. There is, however, no such orientation of the knot with reference to gravity as has been especially described by CARDIFF (1906).

There can be no question that synapsis as here described and figured is a normal contraction stage and is not as LAWSON (1911a) claims simply due to a swelling of the nuclear membrane away from the chromatic reticulum. LAWSON considers that there is no decrease in the chromatin area during synapsis in *Smilacina*. This is certainly not the case in *Carex aquatilis*. Figure 22 shows an entire nucleus with a typical synaptic knot at its greatest contraction. The chromatin mass measures 3,75 μ in diameter, while the chromatin shown in figure 20 extends through a diameter of 7,0 μ.

The events of synapsis are in sharp contrast to those of the prophases of the somatic division, and yet with some striking similarities. In both there is a marked early growth of the nucleus. In somatic prophases the chromosomes maintain a rather constant form. In preparation for synapsis, however, the chromosomes change their shape and the chromatin is drawn out into a delicate thread of considerable length, a condition to which there is nothing comparable in the somatic divisions of the plant and which is plainly an entirely new condition of the chromatin material, a point which is discussed further on.

The synaptic stage with the changes immediately preceding and following it, evidently lasts for some time, perhaps several days. As the knot loosens up we find a thick continuous spirem which appears as one solid homogeneous thread. The loosening continues until the thick spirem (pachyneme) is distributed quite evenly in the nuclear cavity where it is variously twisted about as is shown in figure 23. The stages of this loosening can be followed in the greatest detail, but there is no visible evidence regarding the mechanism of the process. At this stage no longitudinal split can be discerned in the thick spirem and throughout its entire length there appears no indication of the limits of the individual chromosomes.

I have not found intermediate stages between the spirem just described and diakinesis and can not at this time contribute anything further to the question of the origin of the paired chromosomes as they appear in diakinesis. The bivalent chromosomes of diakinesis are sharply defined (fig. 24). There is good evidence that here, also, they are arranged in a continuous series. The suggestion is strong that the thick spirem was double and that the diakinetic pairs have arisen by a contraction in length of the material of each chromosome. At the earliest stages of diakinesis it is to be observed that the chromosomes have not completely rounded up, but are drawn out into thread-like extensions which connect the individuals of successive pairs into the double series thus suggesting that, as noted, the pairing is due to the parallel arrangement of two series of chromosomes.

In diakinesis, as has been almost universally agreed, the pairs of chromosomes lie in the periphery of the nuclear cavity against the nuclear membrane. This position is similar to that of the univalent chromosomes as described above during the early prophases of the somatic divisions (compare figure 24 with 6). This stage in *Carex acuta* was figured by Juel (1900, fig. 30), but he does not show the doubling of the chromosomes which is so conspicuous in my preparations. The chromosomes are roughly elliptical with the sides which are in contact somewhat flattened. They are often elongated in the direction of their alignment in the spirem.

Immediately after diakinesis the continuity of the bivalent discrete spirem becomes still more conspicuous. At first it is variously twisted about in the periphery of the nucleus (fig. 25). When two sister chromosomes lie in the plane of the section the paired condition is evident. When this position is taken by several successive pairs the double spirem can be traced without difficulty, especially if the pairs are rather close together. The spirem is, of course, so twisted that in the sections one of a pair of chromosomes frequently lies below the other and then the pair, except on careful focussing, may appear as one mass.

The important fact that can be established in *Carex* is that following the post-synaptic spirem the chromosomes reappear as oval bodies exactly comparable in size, shape, and number with those of the somatic prophases in the root tip and that these chromosomes here also have a definite serial arrangement. The only difference between this spirem and the vegetative spirem is that here the serially arranged units are double.

Early in diakinesis cytoplasmic changes preparatory to the formation of the heterotypic spindle may be seen. At first there is an accumulation of semi-fibrillar material about the nucleus. From this there develops a felted zone of rather short fibres which gradually become more conspicuous and form a weakly developed multipolar spindle. The multipolar stage is, however, not sharply marked and soon changes to a broad-poled spindle precisely like that of the somatic divisions.

The spindle fibres in all divisions stain readily and the entire spindle figure is conspicuous. While all stages of the early development of the spindle outside of the nucleus can be easily traced, I have not observed any definite intra-nuclear fibres such as have been noted in certain flowering plants especially by ALLEN (1903 and 1905) for *Larix* and *Lilium*. I find no evidence as to the nature of the intra-nuclear mechanism which operates previous to the breaking down of the nuclear membrane. In the prophases of the somatic divisions the chromosomes draw away from the membrane, the spirem becomes centrally aggregated and then loosens somewhat before the nuclear membrane breaks down and the visible spindle fibres grow into the nuclear cavity. In the heterotypic prophases still more complicated processes occur. After diakinesis, however, the double spirem behaves similarly to the single spirem of somatic divisions.

It is noticeable that in all resting nuclei the chromosomes are decidedly peripheral. They lie against the nuclear membrane. In the telophases they appear in contact with the nuclear membrane as soon as it is formed and as the nucleus enlarges they move out with the membrane. During early synapsis there is an indication of the attachment of the leptoneme spirem to the membrane, and in diakinesis the paired chromosomes again appear at the periphery of the nucleus. This behavior seems to indicate that there is some sort of organic connection between the chromosomes and the nuclear membrane.

The paired chromosomes are in some way carried toward the center of the nucleus. The serial arrangement still persists and the chromosomes of a pair become so closely pressed together that there are few which clearly show evidence of their double nature. That they are double is perfectly evident from their number as well as from a study of the stages immediately preceding and following. Such a condition is shown in figure 26. The behavior of the bivalent discrete spirem is entirely similar to that of the single discrete spirem in the prophases of the somatic divisions (compare figs. 25 and 26 with 10 and 11).

As the nuclear membrane breaks down, the fibres extend into the nuclear cavity and the bivalent spirem becomes flattened into the plane of the equatorial plate. Neither here nor in the somatic divisions is there such a shrinkage of the nuclear membrane upon the mass of chromosomes as LAWSON (1911 b) maintains is to be found in *Disporum*, *Gladiolus*, *Yucca*, *Hedera*, and *Allium*.

In a polar view of this stage the whole spirem is in view. The two chromosomes of a pair can be identified when they lie in a profile view. This is the position in which many are found during the early stages of the heterotypic equatorial plate. Figure 27 shows this stage; in this figure there are thirty-seven masses of chromatin nearly all of which unmistakeably consist of paired chromosomes. It is possible that at least two of the masses may consist of individual chromosomes which have either never paired or have already separated. It is interesting to note that at this stage one pair of chromosomes appears slightly larger than the rest. No heteromorphic chromosomes have been observed at any previous stage, yet in the polar view of the equatorial plate of the reduction division this larger pair seems to appear quite constantly. The difference is slight and the halves of the pair are apparently separated in the division as are the others.

The serial arrangement of the paired chromosomes is also strongly suggested at this stage. When the distance between adjacent pairs in different parts of the series becomes less than that between successive pairs, it is often difficult to trace the spirem with certainty. Usually in the early stages of the equatorial plate the series of double chromosomes can be traced throughout most of its length. The spirem is more or less twisted so that one chromosome of a pair may lie above the other. As the metaphase stage approaches the spirem is so oriented that when viewed from the poles all of the pairs lie in this position. Juel's figure of this stage for *Carex acuta* shows fifty-two chromatin bodies, but it is not clear that they are bivalent (Juel, 1900, plate XVI, figure 32). Juel's figures show a suggestion of the serial arrangement of the chromosomes. His failure to discover the bivalence of the chromosomes in diakinesis and in the equatorial plate was perhaps due to the fact that he did not make a comparative study of the somatic divisions.

A lateral view of the heterotypic division figure is shown in figure 28. The homologous chromosomes are about to separate. This stage is similar in general appearance to the early metaphase of a somatic division; but there are, of course, but one half the number of chromosomes in each of the two spirems as they separate and they are here twice as large as the daughter chromosomes of the somatic metaphase. The chromosomes part almost simultaneously throughout the spirem and appear in lateral view in two well ordered ranks. They do not show a split or line of separation for the formation of the daughter chromosomes of the homoeotypic division; this may be due to staining or fixation, though I am inclined to believe from the appearance that the split does not occur at this stage, or that if it does occur, the two halves remain closely joined together.

For a time during the early anaphases the chromosomes are readily identified and the serial arrangement is more or less in evidence in the polar view. As the poles are reached the chromosomes are loosely massed together so that in early telophases there is an aggregation of the individuals. A nuclear membrane soon forms, and, as the daughter nucleus continues to enlarge, clear spaces show between the chromosomes, a nucleole appears and the serial arrangement of the chromosomes is clearly to be observed (fig. 29). The central spindle which was strongly developed during the early anaphases does not produce any pronounced cell plate. This spindle has largely disappeared when the sister nuclei are completely reorganized.

The Homoeotypic Division.

The two sister nuclei reach a completely resting condition, but soon enter on the prophases of the second division. The chromosomes are evidently full-sized throughout this period. At least there is no period of growth such as is seen in the prophases of the somatic divisions. The long axes of the homoeotypic spindle figures may lie at any angle with reference to each other and they may lie in almost any position with reference to the apex of the pollen mother-cell. Figure 30 shows a cell in which the two spindles are at right angles to each other with one lying nearer the apex of the mother cell. This figure shows both a lateral and a polar view of the equatorial plate. The former shows an edge view of a rather flat plate. The polar view makes it possible to count the thirty-seven individual oval chromosomes and there is evidence that here again they are connected together in a series. In such views as are shown in figure 30 the series can be followed throughout most of its length. The behavior of the chromosomes in these homoeotypic divisions is quite similar to that which I have described for the somatic divisions. The spindles are about one-half the size of the heterotypic spindle figure. In the telophases the remains of the central spindles are still present, but not strongly developed, nor do they persist and form cell plates. No central spindle figure or cell plates between the granddaughter nuclei appear in my preparations.

The Development of the Pollen.

Three of the four daughter nuclei, as described by JUEL for *Carex acuta*, now migrate toward the apex of the spore mother-cell and become crowded together. As shown in figure 31 these nuclei are small. They contain for a time conspicuous nucleoles and the chromosomes are clearly defined oval masses distributed about the periphery. The fourth nucleus lies near the center of the general cytoplasmic mass. It is larger than the others, especially as it prepares for the division which forms the vegetative and the generative nuclei. The masses of chromatin which are present at this stage are difficult to count with absolute exactness, but the number is never larger than that of the haploid chromosomes.

JUEL (1900) describes for *Carex acuta* the development of the generative cell by a sort of free cell formation which, however, judging from his figure is quite different from the method of free cell formation in the embryo sac of *Ephedra altissima* as described by STRASBURGER (1880). In JUEL's figure the cell boundary is on the inside of an apparently fibrillar zone. The method of formation of the generative cell, as described by JUEL, is furthermore at variance with what described by STRASBURGER (1884) for *Heleocharis*, and with what is considered to be the common method in Angiosperms. FRIEMANN (1910) has recently studied the development of the generative cell in a number of monocots (*Fritillaria*

Meleagris, *Najas major*, *Triticum vulgare*, *Tradescantia virginica*, *Veratrum album*, *Convallaria majalis*, *Leucojum aestivum*, *Tamus communis*, *Canna indica*, *Epipactis palustris*), and finds that in every case the generative cell is cut off by a cell plate at the periphery of the microspore. It is then set free and migrates into the cytoplasm of the vegetative cell. I have not found the early stages of its formation in *Carex aquatilis*, but its crescent or spindle shaped form (fig. 32) as it lies in the cytoplasm is commonly shown in my preparations and suggests that it is formed in the usual way and not by free cell formation.

The vegetative nucleus becomes quite large and the chromosomes in it lie scattered in series about the periphery with much the appearance observed in resting root-tip nuclei. The generative nucleus gradually becomes more spherical. During these changes the pollen grain enlarges considerably and its central portion is occupied usually by one or more large vacuoles. This increase in size will be appreciated from a comparison of figures 30 and 33. The generative cell and the vegetative nucleus now usually lie near each other and near one side of the pollen grain. The chromosomes are conspicuous, their number is plainly that of the haploid nuclei. The drawing shown in figure 34 is from a section through a generative nucleus in late prophase. The chromosomes are spherical bodies connected in a single continuous series, in appearance and arrangement quite similar to that of the prophase of the division of diploid nuclei (compare fig. 34 with fig. 11). In the early stages of reconstruction the nuclei appear as shown in figure 35. Although these nuclei are very small the chromosomes are sharply differentiated at all stages. Each male cell, when fully formed, possesses a considerable amount of cytoplasm with a clearly defined membrane, as is shown in figure 36. The germ cells are fully formed before the pollen grains are shed from the anther. The vegetative nucleus of the pollen grain is spherical in shape and it usually lies near the large end of the pollen grain. The two male cells lie embedded in the cytoplasm of the vegetative cell. Their nuclei are spherical with the individual chromosomes as noted rather clearly defined. The central part of the pollen grain is coarsely vacuolated and the germ cells lie near the walls of the pollen grain. Usually they are not far from the vegetative nucleus and are often on opposite sides of it.

The vegetative nucleus of the microgametophyte is of about the same size as the nuclei of the somatic cells in the root tip, as will be seen from a comparison of figures 33, 35, and 36 with figure 4. The male nuclei are smaller. The chromatin in them is present, however, as distinct beadlike bodies, and the serial arrangement can be traced in part. These chromatin bodies are certainly not more numerous than the haploid number of chromosomes.

Meanwhile the three microspore nuclei which were crowded into the apex of the old mother-cell have disintegrated. Juel considers that in *Carex acuta* these three nuclei after forming spindles for division fail to complete the mitosis and return to a resting stage. I have not been concerned especially with this point, but my preparations indicate that there is more or less irregularity in the division of these three nuclei, and that as a result from three to six nuclei may be found at the apex. Juel, as I judge, shows five nuclei in this position in one of his drawings (Juel 1900, fig. 42). At first plasma membranes mark the boundaries of these cells (fig. 33). Later they become shriveled into compact masses which are closely pressed into the apex of the mother-cell wall. The central cytoplasmic mass is separated from these degenerating nuclei by a plasma membrane.

The mature pollen grain consists of a large vegetative cell in the cytoplasm of which are two germ cells each with a clearly defined plasma membrane. The wall of the old spore mother cell evidently becomes a part of the wall of the mature pollen grain.

Discussion.

It is evident from the above account that in *Carex aquatilis* the chromosomes can be observed as unit masses at all stages of nuclear development, except during synapsis and the thick spirem stage which follows it. The arrangement of these units in series is also a conspicuous and rather uniform feature.

The earlier evidence supporting the doctrine of the individuality of the chromosomes has been quite fully summarized by Boveri (1904). The evidence is based largely (1) on the uniformity in the number and character of the chromosomes appearing in successive divisions, (2) on the proof that whenever more or less than the usual number of chromosomes enter a nucleus in the eggs of *Ascaris* the same number always appears in later divisions of that nucleus, (3) on the evidence that the loss of chromosome identity during the reticulated condition is only apparent, (4) on the proof that nuclear fusion doubles the number of chromosomes while the reduction division decreases the number by half. Boveri extended the conception of individuality to the extent of regarding the chromosomes as elementary organisms rather than merely permanent cell organs.

Schwarz (1892) describes and figures "Chromatinkugeln" in certain resting nuclei of *Vicia faba*, *Lupinus luteus* and *Hyacinthus orientalis.* Later in the same year Rosen (1892) distinguishes in vegetative nuclei of *Scilla sibirica* two kinds of "Kernkörperchen", the "Eunucleolen" and the "Pseudonucleolen". He shows that the substance of the latter is the same as that of the chromatin.

Zacharias (1895) describes "Nebennucleolen" or "Pseudonucleolen" in *Cucurbita Pepo.* He even observed these bodies in the nuclei of living hair cells. He states that they are chiefly distributed about the periphery of the nucleus and that they stain blue or violet with "Jodgrün und Diamantfuchsin" while the nucleoles stain red. He concludes that these bodies are "Nucleinkörper".

Rosenberg (1904), was the first to discover that in *Capsella*, *Zostera*, and *Calendula* the number of these bodies is the same as that of the long known chromosomes of the division figures; that is the chromosomes are in reality represented in the resting nuclei by definite chromatic masses, the "pseudo-nucleoles". Overton (1905) proposed the term "prochromosomes" for the similar chromatin bodies which he found in the resting nuclei of the somatic cells of *Thalictrum purpurascens* and *Calycanthus floridus*, and which, as he points out, are not only too large to be considered as mere knots of the reticulum, but are of the same number as the chromosomes. He finds that each chromosome is represented by a definite center of chromatin material, the prochromosome, which enlarges directly into the chromosome of the prophases. These are usually much smaller than the chromosomes of the division stages and their shape may or may not be quite similar. The presence of prochromosomes in resting nuclei has since been reported by many investigators. Miyake (1905) for *Galtonia candicans*, Yamanouchi (1906) for *Polysiphonia violacea*, and Rosenberg (1907) for *Hieracium Auricula* and *H. venosum.* Laibach (1907) repeated Rosenberg's studies on *Capsella* and verified the observations regarding prochromosomes; he also found that prochromosomes are present in a number of other Cruciferae. Davis finds prochromosomes in *Oenothera grandiflora* (1909) and in *Oenothera biennis* (1910). Lundegard (1909) adds to the above list of plants possessing prochromosomes the species *Calendula officinalis*, *Achillea Millefolium*, *Anthemis tinctoria* and *Matricaria Chamomilla.* In his paper of 1909 Overton gives a full review of the literature bearing on the theory of the individuality of the chromosomes. Later in the same year Rosenberg (1909b) reported the presence of prochromosomes in forty species of plants, and many still more recent investigators have made similar observations for still other species of plants. In many of the above cases the prochromosomes were not followed throughout the prophases of somatic mitosis, but evidence was given that the chromatin units in the resting nuclei do not exceed the number of chromosomes for the respective species.

The resting nuclei of many species, however, show a finely divided reticulated chromatin. A study of the formation of the reticulum in the telophases and its behavior in the prophases, however, has led in many cases to the identification of so-called "unit reticula" derived from single chromosomes. Boveri (1888 and 1904) found evidence for this view in the lobed form of the nuclei of *Ascaris*. Among those who have contributed positive evidence of the existence of unit reticula in plants are Gregoire and Wygaerts (1904) for *Trillium grandiflorum*; Martins Mano (1905) for *Solanum tuberosum* and *Phaseolus vulgaris*; Gregoire (1906) for three species of *Allium*; Yamanouchi (1910) for *Osmunda cinnamomea*; Stomps (1911) for *Spinacia oleracea*, and Overton (1911) for *Podophyllum peltatum*. The evidence strongly suggests that such reticula are present in all species whose nuclei possess a finely reticulated structure during the resting condition.

The direct growth of the chromatin knots which are present in resting nuclei into chromosomes was observed by Huie (1897 and 1899), who fed the tentacles of *Drosera* and compared the nuclei of the fed tentacles with those in unfed tentacles and was able to recognize the successive steps in the growth of the chromatin masses. Rosenberg (1909 b) repeated Huie's experiments and confirmed the results and pointed out the bearing of the phenomena on the prochromosome hypothesis.

Evidence for the continuity of the chromosomes is found in their persistence through interkinesis. It is generally conceded that in many forms the chromosomes scarcely change their form in passing from the heterotypic to the homoeotypic division. This fact was shown as early as 1899 by Guignard.

Observations on species whose chromosomes show specific and constant differences in size and shape have furnished much evidence for the independent existence of these bodies. Heteromorphism of the chromosomes has been found in plants especially by the following investigators: Rosenberg (1904) for *Listera ovata*, ten large and twenty-two small chromosomes; Strasburger (1882) for *Funkia Sieboldiana*, six large and eighteen small chromosomes; Miyake (1905) for *Galtonia candicans*, twelve large and four small individuals; Schaffner (1909) for *Agave virginica*, four large, three smaller ringshaped and five smaller bivalent chromosomes; CLEMENS MÜLLER (1909) for *Yucca aloifolia*, *Yucca Draconis*, and *Yucca guatemalensis*, various sizes of large and small chromosomes; ROSENBERG (1909a) for *Crepis virens*, two small, two large, and two intermediate in size; TAHARA (1910) for *Crepis japonica*, sixteen chromosomes of various sizes; ISHIKAWA (1910) for *Ginkgo biloba*, twelve bivalent chromosomes of which one pair is large. There is also a vast literature regarding heteromorphism among chromosomes in animals, regarding which adequate summaries have been given by STEVENS, WILSON, and MONTGOMERY.

The chromosomes of *Carex aquatilis* are at their maximum development small bodies. They certainly are slightly, if at all, larger than the so-called chromomeres appearing in the spirem of the prophases of many plants. On this point I have made comparisons of the chromosomes as they appear in figures 10 and 11 with the spirem appearing in the prophases of the onion. The chromosomes in *Carex* at this stages are about 0,5 μ in diameter, while the spirem of the onion is not less than 0,8 μ in diameter. The diameter of the spherical chromosomes is, therefore, somewhat less than the thickness of the spirem in the onion at the time when the latter first shows the longitudinal split.

As far as I can observe the chromosomes in *Carex aquatilis* are homogeneous bodies. At no time during the somatic divisions do they appear to be made up of smaller units, "chromomeres", or "ids" as particularly conceived by WEISMANN (1892) and STRASBURGER (1894). On this point the appearance of the chromosomes during somatic division is most interesting. As already described in detail, the chromosomes are at all stages of the prophases spherical or oval bodies. At no time is their substance drawn out into a series of "ids" which may be divided equally by a longitudinal split. The division of the chromosomes is quantitative, but unless the entire chromosome is of uniform composition, it is difficult to see how the division can be equational.

In marked contrast to this constantly compact organization of the chromosomes of the somatic nuclei are the conditions seen in synapsis. Here the chromosomes are spun out at great length into a fine thread, the folds of which are intricately interlooped together. Out of this a continuous pachyneme thread develops and from this a double series of chromosomes is formed.

The opportunity for the exchange of actual substance between the paternal and maternal germ-plasms during such a union are very great and the various possibilities that exist in such a case are well presented by ALLEN (1905). He points out and discusses the following possibilities;

(1) Complete fusion of homologous idioplasms followed by equational division; (2) Partial fusion followed by equational division of fused portions and a varying distribution of uncombined portions; (3) No actual fusion, but mixture of the homologous idioplasmic units with redistribution of the various elements; (4) Rearrangement of entire chromosomes as units; (5) Interaction (perhaps chemical) between non-fusing portions of idioplasm; (6) Such a separation after contact of fusion that "each germ-cell receives the pure idioplasm of one or the other parent".

It would appear that the various possibilities for exchange and mutual influence during synapsis may be sufficient to account for the observed facts of heredity without assuming that there must be a chance distribution of chromosomes during the heterotypic division.

The serial association of the chromosomes has a significant bearing on the problems as to the general organization of the nucleus. Evidence against the existence of a continuous chromatic spirem at any stage has been brought out by Martins Mano (1905), Gregoire (1906), Overton (1909), Stomps (1911) and others.

Martins Mano (1905) and Gregoire (1906) hold that in various species of *Allium*, and in *Solanum tuberosum* and *Phaseolus vulgaris* there is no spirem, either continuous or segmented at any stage of the somatic divisions. They further hold the view that there is no distinction between linin and chromatin, but this contention has not been accepted, at least as having general significance.

Overton (1909), however, in his studies of the pollen mother-cells of *Thalictrum purpurascens*, *Calycanthus floridus* and *Richardia africana* finds that the prochromosomes in resting somatic and sporogenous nuclei are arranged in parallel pairs with obvious linin intervals, and holds that "these heterogeneous spirems probably remain distinct throughout the life history of the sporophyte". In his more recent studies on *Podophyllum peltatum* (1911) he also emphasizes the fact, that while the spirem of the prophases is not a continuous chromatic spirem, the chromosomes are connected by visible linin intervals into a definite spirem.

Stomps (1911) on the other hand reports that in *Spinacia oleracea* there is no serial alignment of the chromosomes and that the chromosomes even pass through synapsis without any evidence of a continuous serial arrangement.

In the older literature conspicuous cases of the presence of a chromatic spirem in resting nuclei are reported for the gland cells of *Chironomus* (Balbiani, 1881) and the epithelial cells of various other insects (Van Gehuchten, 1890). Balbiani even suggests that the spirem arrangement may be the normal condition in resting nuclei and that the reticulated appearance commonly observed is an artefact. FLEMMING (1882) in considering this point reinvestigated the nuclei of *Chironomus* larvae and verifies BALBIANI's observations as to the presence of a chromatic spirem. He remarks that in these cases the organization of the resting nuclei is very similar to that at the beginning and the end of nuclear division.

RABL's (1885) conception of polarity in the nuclei of the salamander is based on the uniform and constant convergence of the spirem loops toward the polar field. He clearly shows that although the chromosomes give off anastomosing branches there are in the reticulum traces of the boundaries of the chromosome loops. He points out that this is evidence for the individuality of the chromosomes. A study of his figures shows also that the serial arrangement of the chromosomes seen most clearly in the spirem can also be traced with considerable clearness in these resting nuclei.

A classical example of the intimate association of chromosomes in series is seen in *Ascaris megalocephala bivalens.* Here there are long chromatin rods which behave like individual chromosomes in the germ cell divisions, but in somatic divisions each breaks up into about twenty segments which are to all appearances chromosomes. EDWARDS (1910) has shown that in *Ascaris lumbricoides* the so-called sex element of the maturation divisions is a group of five chromosomes. Other evidence similar to the above shows that chromosomes may be associated in series making what may be called plurivalent chromosomes. The condition in *Carex aquatilis* is somewhat similar in that in the prophases of the reduction division the chromosomes are connected up in a homogeneous spirem quite as they are in the embryonic divisions of *Ascaris.*

Since STRASBURGER (1905) reported the presence of paired chromosomes in dividing diploid nuclei in *Galtonia* and *Funkia* much evidence has appeared to show that such an arrangement of the somatic chromosomes is present in many plants. This pairing may be so intimate that each pair appears as one double chromosome, a condition shown by OVERTON (1909, p. 23). Other cases of constant pairing in somatic nuclei have been reported, especially by CLEMENS MÜLLER (1909) in various species of *Yucca*; ROSENBERG (1909 a) in *Crepis virens* and (1909 c) in *Drosera*; GATES (1911) in *Oenothera*; STOMPS (1911) in *Spinacia.*

I shall not here discuss the much disputed question of end to end or side by side association of homologous chromosomes during synapsis. The evidence is, I believe, conclusive that a paired condition is a feature of organization in the chromosomes of the somatic nuclei in many species, and that as Overton (1909) shows this may extend to a pairing of two complete spirems.

In *Carex aquatilis* there is, as has been shown above, a permanent serial arrangement of the chromosomes, especially during the history of the somatic nuclei. In synapsis, however, the series of individual chromosomes is changed to a slender continuous chromatic spirem. After the contraction and pachyneme stage there emerge the bivalent chromosomes of diakinesis. The composition of these pairs as influenced by the events of synapsis has already been discussed.

In the thick spirem and the stages following it, I find no evidence of a strepsineme stage. The rounded chromosomes appear in pairs. They are nearly isodiametrical, as in the case of various insects, with no apparent twisting or crossing of parts. Hence in *Carex aquatilis* there is no possibility of such phenomena as Janssens (1909) describes under his "chiasmatypie" theory. If, however, the loops of the bivalent spirem should not straighten out as the spirem enters the heterotypic equatorial plate but should cross each other, there would be opportunity at this stage for chiasmatypic readjustment of parts of the paired spirems similar to that which Janssens describes between parts of paired chromosomes.

The double spirem appearing in diakinesis passes into the equatorial plate where two complete series part. It is, however, possible that in the more or less twisted condition of the double spirem just previous to the formation of the equatorial plate of the heterotypic division, there may be a rotating of certain pairs in the double spirem so that a constant association of the same chromosomes may not prevail. The marked persistance of the serial relationship, however, suggests strongly that each of the two series may remain as such throughout all stages of nuclear development. Even though there be a rotation of various pairs there are certain parts of the series in which the chromosomes remain in the same alignment. This decreases the opportunity for a simple chance distribution of the chromosomes in the reduction division.

From these observations it would appear that the serial arrangement of the chromosomes is an important factor influencing the degree of chance distribution of the maternal and the paternal chromosomes.

The studies here reported were pursued at the University of Wisconsin during the years 1909—11, and at the New York Botanical Garden during 1911—1912, and throughout the investigation the writer has had the helpful criticism and direction of Professor R. A. Harper.

Summary.

1. The chromosomes in *Carex aquatilis* are small spherical bodies which at their maximum development are not more than 0,5 μ in diameter.

2. These chromosomes are present in all resting nuclei as visible units of definite number.

3. These individual chromosomes can be traced as such through all stages of both somatic and germ-cell divisions with the exception of the various stages of synapsis.

4. The spirem of the prophases is discrete: it consists of separate chromosomes whose identity is clearly marked at all stages.

5. This serial arrangement of the chromosomes is not lost in the division stages. The daughter chromosomes are arranged in a series which remains in evidence during the resting stages.

6. I am not able to find a longitudinal split through the chromosomes during the prophases. The split first appears as the daughter chromosomes separate on the equatorial plate.

7. In the prophases of synapsis the chromosomes spin out at great length into a thin thread, the leptoneme spirem, which is apparently intricately looped and folded on itself.

8. Synapsis is a well marked stage which can not be regarded as an artefact, and it is followed by a well marked pachyneme spirem which becomes evenly distributed throughout the nucleus.

9. In diakinesis the bivalent chromosomes form a more or less obvious heterogeneous double spirem.

10. The heterotypic division is a separation of whole chromosomes which have previously been paired.

11. In *Carex aquatilis*, as in *Carex acuta* (Juel, 1900), but one microspore nucleus develops into a pollen grain.

New York Botanical Garden, N. Y. City, March 1912.

Literature Cited.

Allen, C. E. (1903). The early stages of spindle formation in the pollen mother cells of Larix. Ann. Bot. Vol. VII. p. 281—311.

—— (1905). Nuclear division in the pollen mother-cells of Lilium canadense. Ann. Bot. Vol. XIX. p. 189—258.

Balbiani, E. G. (1881). Sur la structure du noyau des cellules salivaires chez le Chironomus. Zool. Anz. Bd. IV. S. 637—641, 662—666.

BOVERI, T. (1888). Die Befruchtung und Teilung des Eies von Ascaris megalocephala. Jena.

—— (1904). Ergebnisse über die Konstitution der chromatischen Substanz des Zellkernes. Jena.

CARDIFF, I. D. (1906). A study of synapsis and reduction. Bull. Torrey Bot. Club. Vol. XXII. p. 271—306.

DAVIS, B. M. (1909). Cytological studies on Oenothera. I. Pollen development of Oenothera grandiflora. Ann. Bot. Vol. XXIII. p. 551—571.

—— (1910). Cytological studies on Oenothera. II. The reduction divisions of Oenothera biennis. Ann. Bot. Vol. XXIV. p. 631—651.

EDWARDS, C. L. (1910). The idiochromosomes in Ascaris megalocephala and Ascaris lumbricoides. Arch. f. Zellforschung. Bd. V. S. 422—428.

ELFVING, FREDRIK. (1879). Studien über die Pollenkörner der Angiospermen. Jenaische Zeitschrift. Bd. XIII. S. 1—28.

FLEMMING, WALTHER. (1882). Zellsubstanz, Kern- und Zellteilung. Leipzig.

FRIEMANN, WILHELM. (1910). Über die Entwicklung der generativen Zelle im Pollenkorn der monocotylen Pflanzen. Inaug.-Diss. Bonn.

GATES, R. R. (1911). Chromosome Reduction. Bot. Gaz. Vol. LI. p. 321—344.

GRÉGOIRE, VICTOR. (1906). La structure de l'élément chromosomique au repos et en division dans les cellules végétales. La Cellule. T. XXIII. p. 311—353.

GRÉGOIRE, VICTOR et WYGAERTS, A. (1904). La reconstruction du noyau et la formation des chromosomes dans les cinèses somatiques. La Cellule. T. XXI. p. 7—76.

GUIGNARD, LÉON. (1899). Le développement du pollen et la réduction chromosomique dans Naias major. Arch. Anat. Micr. Vol. II. p. 455—509.

HUIE, LILY H. (1897). Changes in the cell organs of Drosera rotundifolia produced by feeding with egg-albumen. Quart. Journ. Micr. Sci. Vol. XXXIX. p. 387—425.

—— (1899). Further study of cytological changes produced in Drosera. Quart. Journ. Micr. Sci. Vol. XLII. p. 203—222.

ISHIKAWA, M. (1910). Über die Zahl der Chromosomen von Ginkgo biloba. Bot. Mag. Tokyo. Bd. XXIV. p. 225—226.

JANSSENS, F. A. (1909). La Théorie de la Chiasmatypie. La Cellule. T. XXV. p. 389—411.

JUEL, H. O. (1900). Beiträge zur Kenntnis der Tetradenteilung. III. Die Entwicklung der Pollenkörner bei Carex. Jahrb. Wiss. Bot. Bd. XXXV. S. 649—656.

LAIBACH, FRIEDRICH. (1907). Zur Frage nach der Individualität der Chromosomen im Pflanzenreich. Beih. Bot. Centralbl. Bd. XXII. S. 191—210.

LAWSON, A. A. (1911a). The phase of the nucleus known as synapsis. Trans. Roy. Soc. Edin. Vol. XLVII. p. 591—602.

—— (1911b). Nuclear osmosis as a factor in mitosis. Trans. Roy. Soc. Edin. Vol. XLVIII. p. 137—161.

LUNDEGÅRD, HENRIK. (1909). Über Reduktionsteilung in den Pollenmutterzellen einiger dikotylen Pflanzen. Svensk Bot. Tidskrift. Bd. III. S. 78—124.

MARTINS MANO, THOMAZ. (1905). Nucléole et chromosomes dans le méristème radiculaire de Solanum tuberosum et Phaseolus vulgaris. La Cellule. T. XXII. p. 57—77.

Miyake, Kiichi. (1905). Über Reduktionsteilung in den Pollenmutterzellen einiger Monokotylen. Jahrb. Wiss. Bot. Bd. XLII. S. 83—120.

Müller, Clemens. (1909). Über karyokinetische Bilder in den Wurzelspitzen von Yucca. Jahrb. Wiss. Bot. Bd. XLVII. S. 99—117.

Overton, J. B. (1905). Über Reduktionsteilung in den Pollenmutterzellen einiger Dikotylen. Jahrb. Wiss. Bot. Bd. XLII. S. 121—153.

—— (1909). On the organization of the nuclei in the pollen mother-cells of certain plants. Ann. Bot. Bd. XXIII. p. 19—61.

—— (1911). On the organization and reconstruction of the nucleus in the root-tips of Podophyllum peltatum. Science N. S. Vol. XXXIII. p. 193.

Rabl, Carl. (1885). Über Zellteilung. Morph. Jahrb. Bd. X. S. 214—336.

Rosen, Felix. (1892). Beiträge zur Kenntnis der Pflanzenzellen. Beitr. Biol. Pfl. (Cohn). Bd. V. S. 443—458.

Rosenberg, O. (1904). Über die Individualität der Chromosomen im Pflanzenreich. Flora. Bd. XCIII. S. 250—259.

—— (1907). Cytological studies on apogamy in Hieracium. Botan. Tidsskr. Bd. XXVIII. p. 143—170.

—— (1909a). Zur Kenntnis von den Tetradenteilungen der Compositen. Svensk Bot. Tidskrift. Bd. III. S. 64—77.

—— (1909b). Über den Bau des Ruhekernes. Svensk Bot. Tidskrift. Bd. III. S. 163—173.

—— (1909c). Cytologische und morphologische Studien über Drosera longifolia × D. rotundifolia. Kungl. Sv. Vet.-akad. Handl. Bd. XLIII. S. 1—64.

Sargant, Ethel. (1896). The formation of the sexual nuclei in Lilium Martagon I. Oogenesis. Ann. Bot. Vol. X. p. 445—477.

—— (1897). The formation of the sexual nuclei in Lilium Martagon. II. Spermatogenesis. Ann. Bot. Vol. XI. p. 187—224.

Schaffner, J. H. (1909). Reduction divisions in the microsporocytes of Agave virginica. Bot. Gaz. Vol. XLVII. p. 198—214.

Schwarz, Frank. (1892). Zellkerne. (Die morphologische und chemische Untersuchung des Zellkernes). Beitr. Biol. Pfl. (Cohn). Bd. V. S. 76—123.

Stomps, T. J. (1911). Kernteilung und Synapsis bei Spinacia oleracea L. Biol. Centralblatt. Bd. XXXI. S. 257—308.

Strasburger, Eduard. (1880). Zellbildung und Zellteilung.

—— (1882). Über den Teilungsvorgang der Zellkerne und das Verhältnis der Kernteilung. Bonn.

—— (1884). Neue Untersuchungen über den Befruchtungsvorgang bei den Phanerogamen als Grundlage für eine Theorie der Zeugung. Jena.

—— (1894). The periodic reduction of the number of chromosomes in the life-history of living organisms. Ann. Bot. Vol. VIII. p. 281—316.

—— (1905). Typische und allotypische Kernteilung. Jahrb. Wiss. Bot. Bd. XLII. S. 1—71.

Tahara, M. (1910). Über die Zahl der Chromosomen von Crepis japonica Benth. Bot. Mag. Tokyo. Bd. XXIV. S. 23—28.

Van Gehuchten, A. (1890). Recherches histologiques sur l'appareil digestif de la larve de la Ptychoptera contaminata. La Cellule. T. VI. p. 185—289.

Weismann, August. (1892). The Germplasm. Jena. (English Trans. N. Y.).

Winiwarter, H. von. (1901). Recherches sur l'ovogénèse et l'organogénèse de l'ovaire des mammifères (Lapin et Homme). Arch. de Biol. T. XVII. p. 33—199.

Yamanouchi, Shigeo. (1906). The life history of Polysiphonia violacea. Bot. Gaz. Vol. XLV. p. 401—449.

—— (1910). Chromosomes in Osmunda. Bot. Gaz. Vol. XLIX. p. 1—12.

Zacharias, Eduard. (1895). Über das Verhalten des Zellkernes in wachsenden Zellen. Flora. Bd. LXXXI. (Ergänzungsband.) S. 217—266.

Explanation of Figures in Plates XI and XII.

All the figures were drawn with the aid of a camera lucida, and with a Zeiss apochromatic 3 mm. objective and compensating ocular 18. × 2400.

Plate XI.

Fig. 1. Cells in the plerome. Nuclei containing chromosomes with the serial arrangement in evidence.

Fig. 2. Cell in the wall of an ovule. Resting condition.

Fig. 3. Tapetal cell. Early prophase.

Fig. 4. Cells in the embryonic region of a root-tip: *a* und *b* are in the plerome; *c* and *d* are in the region of the periblem and dermatogen; *e* is in the calyptrogen. Chromosomes are present in all of the nuclei.

Fig. 5. Cells in the periblem: *a* during late telophase; *b* during early prophase. Upper portion of nucleus *b* not in the section.

Fig. 6. Cell in periblem during prophase; lower portion of nucleus not in the section.

Fig. 7. Cells in the filament of a stamen. *a* during prophase, *b* in resting stage.

Fig. 8. Cell during mid-prophase. Spirem is wound about the nucleole.

Fig. 9. Optical section through a nucleus in the same stage as shown in fig. 8. In the sequence of division this stage follows the one shown in fig. 11.

Figs. 10 and 11. Stages in prophase showing the discrete spirem and the early appearance of spindle fibres.

Fig. 12. Prophase after nuclear membrane has broken down.

Fig. 13. Lateral view of an equatorial plate.

Fig. 14. Polar view of an equatorial plate in the early stages of its development.

Fig. 15. Cell in anaphase, lateral view.

Fig. 16. Late anaphase showing rather heavy spindle and polar fibres.

Fig. 17. Early telophase. Cell plate forming.

Fig. 18. Telophase. Chromosomes separating out in series.

Plate XII.

Fig. 19. Nucleus of microspore mother-cell in the resting stage. Lower part of nucleus not in the section.

Fig. 20. Nucleus preparing for synapsis. Chromosomes are spinning out and show attachments to nuclear membrane as at *a* and *b*.

Fig. 21. Nucleus in a stage preceding synapsis. Chromosomes spun out into a fine leptoneme which is attached to the nuclear membrane at several points.

Fig. 22. Synapsis.

Fig. 23. Pachyneme stage of post-synapsis.

Fig. 24. Diakinesis. Chromosomes in pairs at the periphery. Spirem somewhat in evidence.

Fig. 25. Stage following diakinesis. Bivalent spirem drawing in from the periphery. Lower part of the nucleus in cell *a* not shown.

Fig. 26. A stage somewhat later than the one shown in fig. 25. Spirem is more toward the center of the nucleus. The bivalent chromosomes appear more compact.

Fig. 27. Polar view of the equatorial plate of the heterotypic division: 37 pairs of chromosomes in view; most of them in profile. The serial arrangement can be traced for some distance.

Fig. 28. Lateral view of the equatorial plate of the heterotypic division just previous to the separation of the paired chromosomes.

Fig. 29. Telophase of the heterotypic division.

Fig. 30. Homoeotypic divisions; both polar and lateral views shown.

Fig. 31. Cell showing the four microspore nuclei. Only the large central one will develop; the three at the apex will eventually disintegrate. All show the chromosomes.

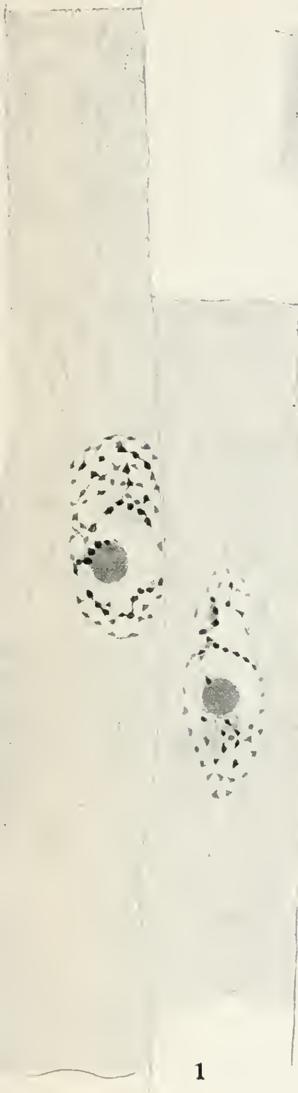
Fig. 32. Stage showing the elongated generative cell. The vegetative nucleus lies at a lower level and is only shown in part.

Fig. 33. Median section through a pollen grain showing vegetative nucleus, generative cell which is now rounded, and two of the cells at the apex. Chromosomes are present in all the nuclei and the serial arrangement is in evidence.

Fig. 34. Portion of a pollen grain showing generative cell in prophase. The spirem consists of individual chromosomes.

Fig. 35. Showing telophase in the division of the generative cell. At the apex of the grain is shown a portion of the plate formed by the disintegrating nuclei.

Fig. 36. Portion of a mature pollen grain showing nucleus of the vegetative cell and the two germ cells. The chromosomes are visible in all three nuclei.



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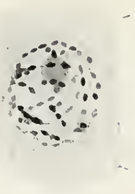

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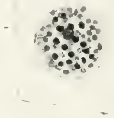

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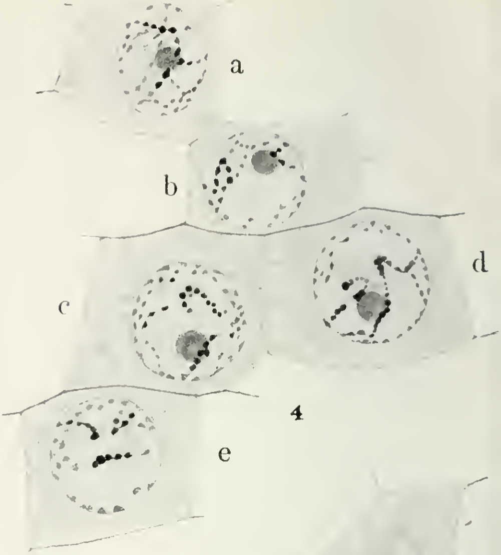

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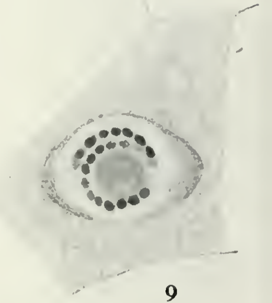

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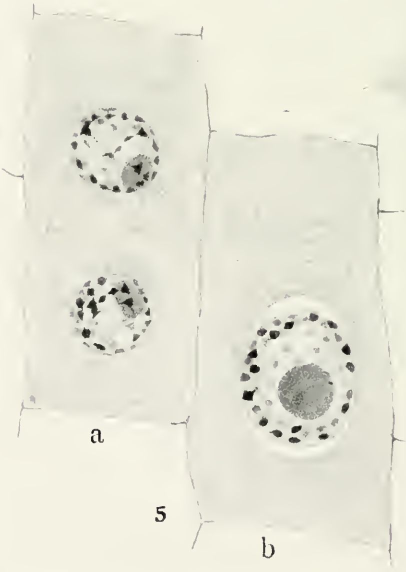

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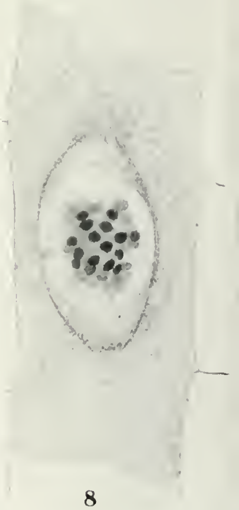

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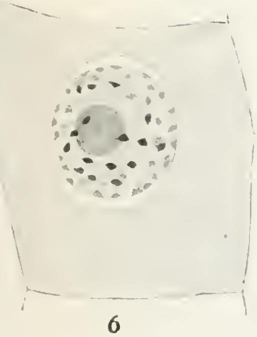

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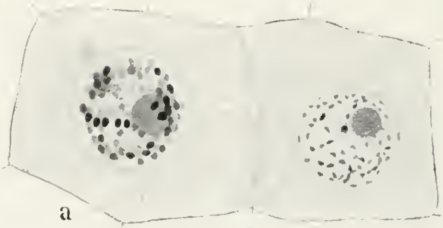

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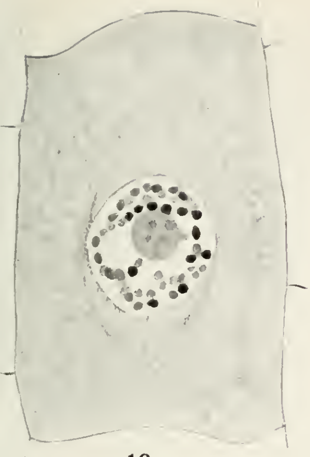

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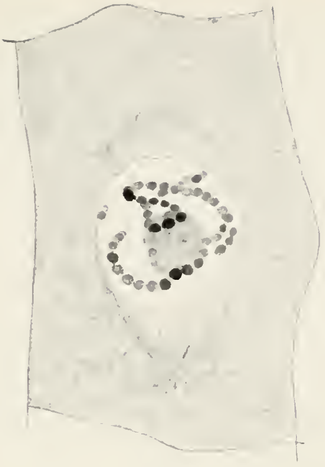

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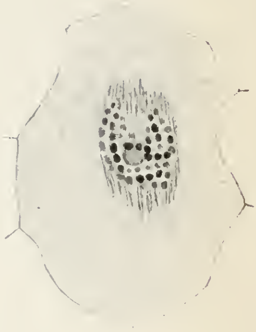

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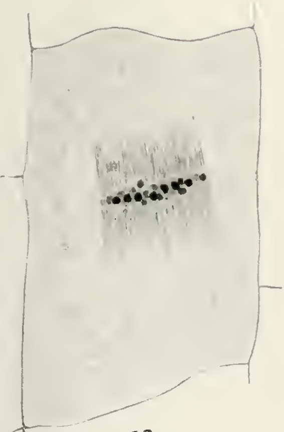

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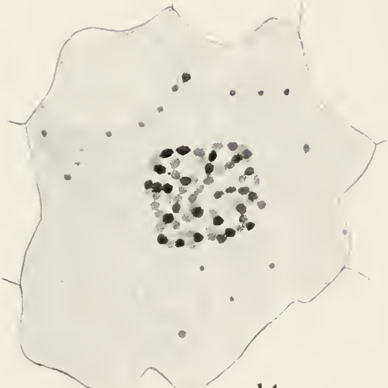

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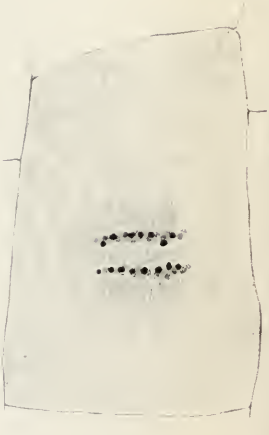

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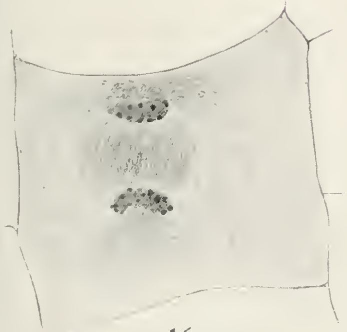

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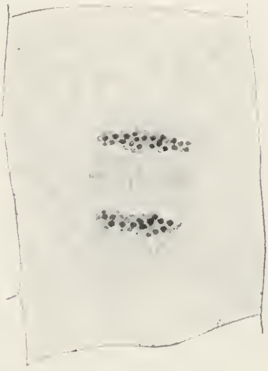

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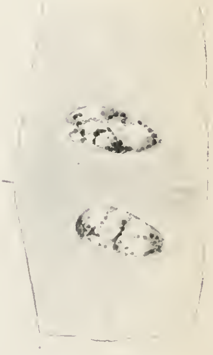

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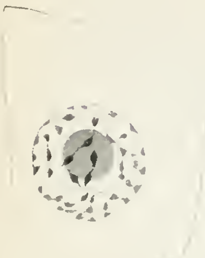

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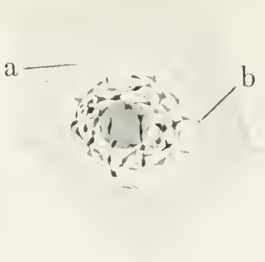

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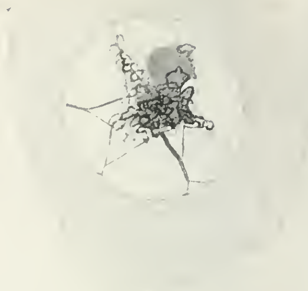

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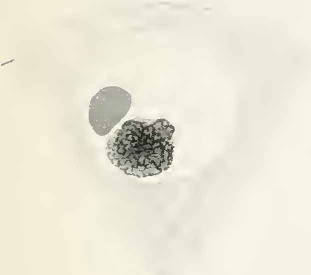

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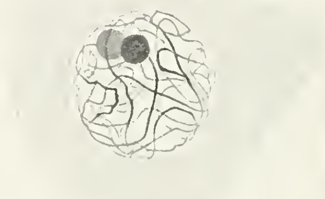

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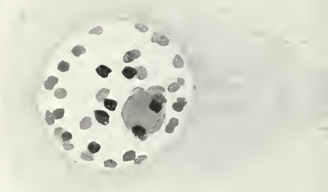

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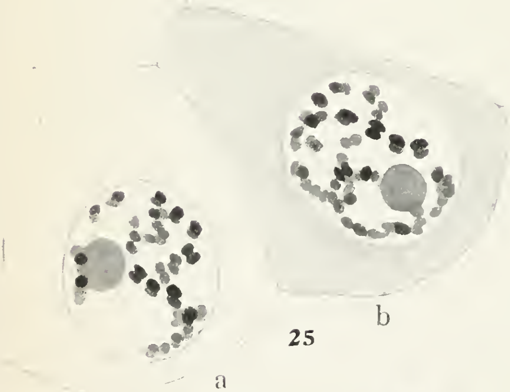

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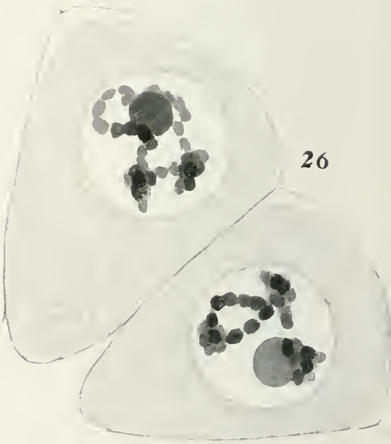

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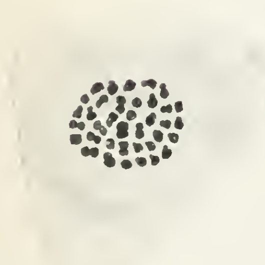

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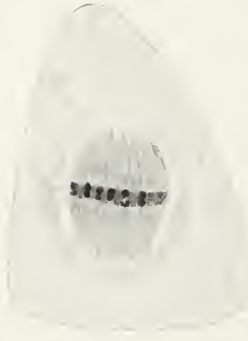

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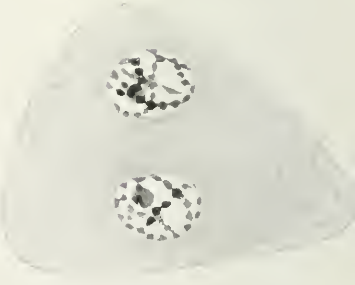

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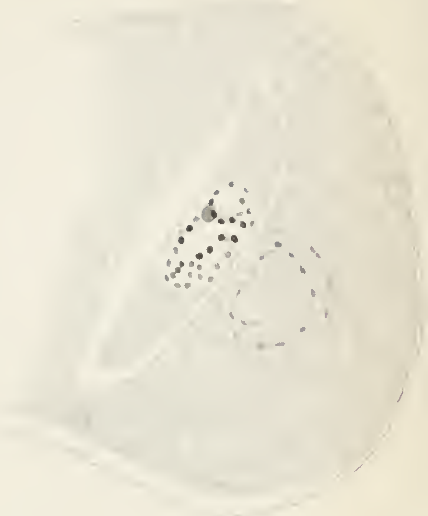

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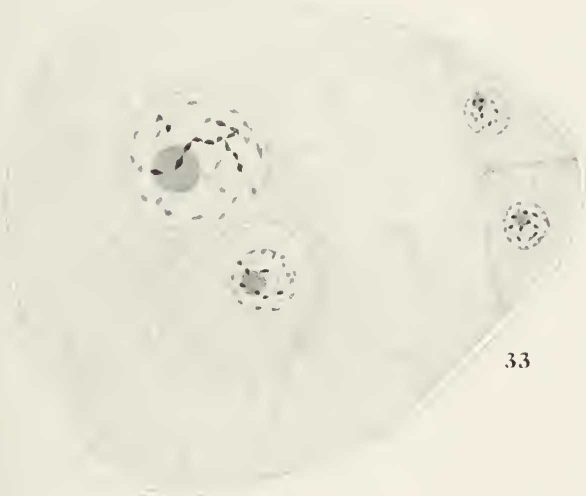

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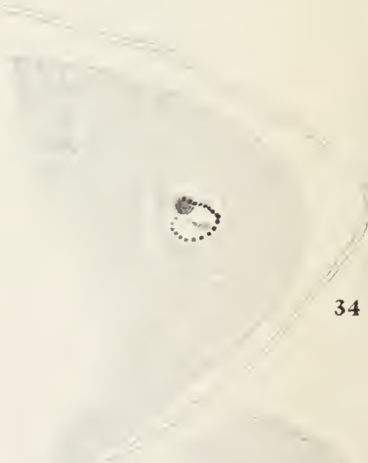

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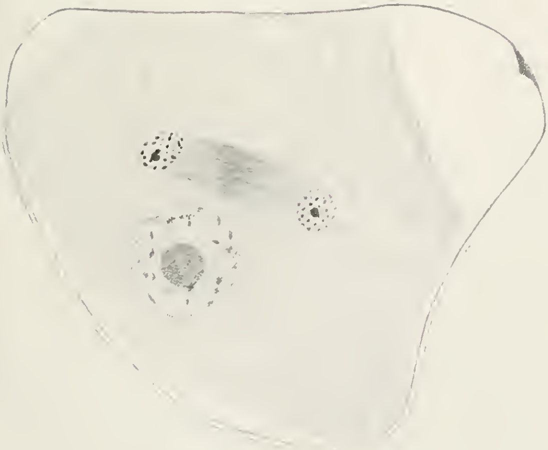

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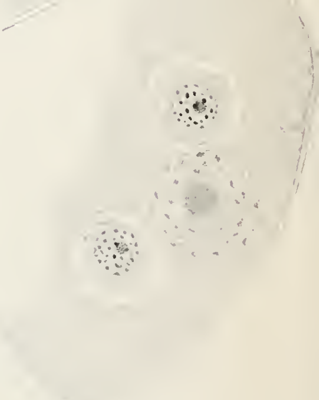

36

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